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Boston rapid transit schemes are progressing slowly, but as rapidly as is consistent with prudence, says Mayor Matthews. Mr. Howard A. Carson, the Chief Engineer, is now reviewing and verifying the estimates of cost, upon the strength of which the late rapid transit bill was passed. When this work is completed, the commission will be ready to talk about contracts.

Whether a 30-year franchise granted to a Detroit street-railway company having only 14 years of corporate existence remaining holds good for only 14 years or for the full 30 years is a question which has just been decided in favor of the longer term by the U. S. Court of Appeals. In 1879 the city council of Detroit extended the franchise of the Detroit Street Railway Co. for thirty years from that date, the company agreeing to certain changes in return in the interest of the city. The corporate existence of the company expired in 1893, but prior to that time the company sold its rights and property to another company, which since then has in turn sold out to the Detroit Citizens' Street Railway Co. Upon the expiration of the old company's charter, the city brought action to compel the taking up of the tracks, on the ground that the right to use the streets expired with the life of the old company, but this has been held to be a wrong construction of the law, as stated above. A decision in the U. S. Circuit Court favorable to the city is reversed by the ruling of the Court of Appeals. An effort to secure a new franchise was made in 1891, and was so far successful as to fail only through the veto of Mayor Pingree. The new franchise would have avoided the difficulties described. It is quite possible that there will be further litigation in the matter, as it is claimed that the meaning of certain points in the Michigan State Constitution is involved, and that the decision already rendered does not prevent taking up the matter in the State courts.

The Kuhlmann counter-weight cable system of operating electric railways on steep grades is to be adopted for an extension of the electric railway system of Providence, R. I., over College Hill. The extension will have a maximum grade of 17½% and an average grade of 14%. The system is the invention of Mr. J. P. F. Kuhlmann, of Seattle, Wash., and was fully illustrated and described in our issue of June 29, 1893.

Fast train service is to be established between New Orleans and San Francisco by the Southern Pacific Co., the rate of speed to be 45 miles per hour, with stops only at principal cities and division terminals. The distance is 2,489 miles, and the present express trains are scheduled for 116½ hours, or an average speed of only 21½ miles per hour. There are, however, 243 stops in this distance, and it is the intention to greatly cut down the number of these, and make the remaining as brief as possible. This move is probably made to favor the winter tourist travel to California.

The fastest mile ever made by a horse in harness was the record made by the pacer "Flying Jib," at Chillicothe, O., Oct. 4. The horse, with a running mate, made the mile in 1 min. 58¼ sec.

The proposed Intercontinental Railway, from the Isthmus of Tehuantepec to south Peru, will cost, complete and equipped for service, $45,000 per mile, says Chief Engineer William F. Shunk in his report, handed in on Oct. 5.

A gas-well of unusual volume has been struck on Indiana Creek, 10 miles from Willeyville, W. Va. The Victor Oil Company drilled into the "sand" on Sept. 6 and developed a gas-well with enormous pressure, the 4,000-lb. tools being thrown from the well and wrecking the derrick. It subsided in about a week, but has now broken out with "ten-fold" power, and experts pronounce it one of the biggest, if not the biggest, on record.

The new promoters of the Panama Canal are at least making a bold "bluff" of doing some work. Mr. Chas. Palin, Belgian Consul to Columbia, arrived in New York from Panama on Oct. 5, and says quite a number of men were at work and 2,000 Italians and Hungarians were expected on Oct. 26. Some of the rusty old machinery has been cleaned up and repaired for work, and houses are being prepared for the new men. Meanwhile the Paris syndicate preserves a perhaps wise silence as to the capital in hand and their real purpose, and refused, at the general meeting of stockholders held in Paris on Oct. 4, to say how much of the $3,600,000 said to be deposited was subscribed for by the public.

The Great Kanawha Falls Water Power, Electrical Manufacturing & Land Co. has been formed at Charleston, Kanawha Co., W. Va., with a capital stock of $2,000,000. It is proposed to transmit current for power and lighting throughout an area with a radius of 20 to 30 miles. Among the principal stockholders are: Chas. M. Reed, Baltimore, Md.; A. McClintock, Philadelphia, and A. O. Patton, Charleston, W. Va.

Numerous schemes for enlargements of the Philadelphia water supply are being brought forward. Mr. John L. Ogden, Chief of the Bureau of Water, has just made plans for a new pumping station on the Delaware River which would cost, with the tributary system of mains, over $2,000,000. The items as reported in the Philadelphia papers are as follows: Three 60,000,000-gallon pumping engines, $225,000; one reserve pump, capacity not stated, $85,000; boilers, $85,000; stand-pipe, $25,000; four miles 48-in. mains, $337,000; three miles 35-in. mains, $110,880; five miles 20-in. mains, $118,800; smaller mains, $1,000,000. Seven additional pumps, with a combined capacity of 155,000,000 gallons, have already been provided for by the city council. These will make the total pumping capacity of the city's works 347,000,000 gallons, "sufficient, theoretically, if the ratio of consumption does not increase, to provide water for the city until 1900."

The most serious railway accident of the week was the derailment of a fast freight train, Oct. 8, on the Chicago, Rock Island & Pacific Ry., near Seymour, Ia., in which three men were killed.—A passenger train on the Cincinnati Southern Ry. was derailed by train-wreckers near Bristol, Tenn., Oct. 7. The train consisted of eight cars, all of which, except the rear Pullman sleeping car, were burned. Ten persons were injured.

A steam pipe at the Illinois Steel Works, Chicago, Ill., burst on Oct. 8, and two men were killed and five seriously injured.

A dynamite explosion occurred at Ironwood, Mich., Oct. 8, from the too frequent cause of carelessness in thawing the cartridges. A miner had put half a box of dynamite in or on the stove, and the explosion followed, killing four persons and seriously injuring three others.

A great colliery fire has been started at Shamokin, Pa., through the careless use of naked lamps by carpenters repairing the bratticing. The greasy timbers caught fire and the flames were drawn in by the air current. Five men were killed by suffocation, and the whole mine is said to be on fire, throwing 2,000 men out of employment.

Compressed gas for locomotive headlights has been used for some years in South America, and this light is being applied on 25 suburban engines now being built by the Brooks Locomotive Works for the Central Railway of Brazil. The Pintsch system is used, which is controlled by the Safety Car Heating & Lighting Co., of New York city. The new engines have gas lamps in two 20-in. headlights, four signal lights and a gage light in the cab. The gas tank is below the floor of the cab, and the lights at either end can be turned down according to which way the engine is running. In tests recently made on an engine in the Hoboken yards of the Delaware, Lackawanna & Western R. R., it was found that while the light was much more powerful than the oil lamp commonly used, it did not interfere with reading the signals, as the electric headlight is said to do.

Inverted arc lamps for interior lighting have been introduced in the mills of the Goff Braid Co. at Pawtucket, R. I., and with very satisfactory results. As explained some time ago, in this journal, in this system the ceiling of the room is kalsomined or whitewashed. The arc lamps are placed as high as possible and beneath them is placed an inverted cone-shaped reflector, which cuts off direct view of the arc from any part of the room, and reflects the light to the ceiling, from which it is again reflected to the room. The system gives a more uniformly distributed light than any other in use and is claimed also to give some 40% more light for the same consumption of current. In the Goff mill seven arc lamps furnish light for a room 50 × 200 ft., or 1,430 sq. ft. per lamp. It should be said that there are few belts or columns in the room, and were the lights thus obstructed, more lights to the area would doubtless be necessary.

Electric tail lights are being used on two of the "F. F. V." express trains over the Chesapeake & Ohio. The lamps receive current from the same batteries which are used for train lighting.

According to the annual report just issued by the Bureau of Naval Intelligence of the U. S. Navy Department, the following are the most marked features of naval progress during the year. The superiority of the American Harveyizing process has now been universally recognized and it has been adopted by the leading nations and manufacturers. The U. S. 12-in. gun is capable of perforating any armor yet afloat at fighting range and the projectiles carry a formidable bursting charge. In rapid-fire guns, important advances have been made in the gun-mounts. One of the new automatic machine guns can fire 200 1-lb. steel shells a minute and perforate 2 ins. of iron at 100 yds. The English naval estimates for the current fiscal year amount to $84,399,246; France has appropriated $53,560,648; Russia, $21,158,000; Germany, $17,593,000; Italy, $18,502,000; Holland, $6,278,000, and Japan set aside last year $5,080,000. The United States has only about $6,000,0000 available. The naval estimates here given aggregate the enormous sum of $213,170,994 set aside for increasing and maintaining the world's navies.

The annual report of Mr. S. W. Lamoreux, Commissioner of the General Land Office, has been issued, covering the last fiscal year. He reports that during the past year an aggregate of about 10,000,000 acres of public lands were sold for $2,767,824. Over 8,000,000 acres were disposed of through original homestead entries; state selections rank next in amount, and then come railway lands. Of agricultural patents, 35,255 were issued, covering 5,640,800 acres, and among these were 4,120 timber culture patents. The commissioner notes that with the Cascade Range and Ashland forests, in Oregon, there are now 17 public forest reservations, covering 17,560,800 acres. But owing to lack of legislation little has been done towards the management and utilization of these reservations. They are practically no more protected now than are the unreserved public lands of the United States. He calls attention to the fact that under the law permitting the purchase of timber lands at $2.50 per acre the government is rapidly losing title to thousands of acres that should be preserved as permanent sources of timber supply. He recommends an appropriation of at least $50,000 for protecting the timber.

USE OF ICE-BORING MACHINES FOR RIVER SURVEYS.*

By Joseph Ripley.

The United States has improved the navigation of the St. Mary's River by building new locks, deepening and enlarging the St. Mary's Falls Canal, and by dredging numerous shoals in the river. The project of 1870 was for a channel 16 ft. deep, with a minimum width of 300 ft. Later on the project was changed, so that at the present time the improvements are being made for a channel 20 or 21 ft. deep, depending on location and character of material of the river bed.

Having adopted the method of bank measurements in place, as being the most accurate one for determining the amount of material removed above specified grade planes, it was necessary to make detailed surveys of all the shoals. These were generally made in the summer time, but nearly every winter since 1870 soundings have been taken through the ice on the canal or river at places where it was necessary to check the amount of the season's work as estimated from the scow loads, or where it was difficult to sound from boats or raft on account of the rapids or the frequent passing of steamboats.

At first the ordinary woodman's ax was used to chop the holes through the ice. After chopping through to water, or as deep as convenient with the axes, then ice chisels were used to finish cutting the holes. The thickness of the ice was usually from 12 to 30 ins., but adjacent to docks and the canal piers it was often 6 ft. thick. On account of the curved edge of the axes, they would not cut rapidly after the holes were 15 ins. deep. A change was made to the ship carpenter's ax, which had a broad straight edge, with square corners. With helves 3½ ft. long, the weight of each ax was 6½ lbs.

The best choppers could not endure more than 10 to 12 days' continuous work, as the muscles of the forearm would be badly strained from the constant shock, it being necessary to grasp the handle firmly to prevent the ax from turning.

The average cost per sounding of the several ice surveys, where axes were used, ranged from 5 to 15 cts., the mean being about 8 cts. per sounding.

Various devices were considered for making the holes easily and quickly, but none were successful, till in January, 1892, a local machinist succeeded in making an auger that would bore a 3-in. hole through ice. Though the auger was poorly made and the machine crude, it was purchased by the United States and used on the Hay Lake ice survey during March, 1892.

Two men by working very hard could bore as many holes in a day as three axemen could chop. This was not very satisfactory, but it showed the possibilities of the machine, and I believed that it could be developed so as to completely solve the problem of making the holes rapidly. While in operation the defects of the machine had been fully noted and the necessary improvements were afterwards carefully determined. Two new machines were built, and were used on the surveys of last winter for three months. The average day's work of two men with a machine was equivalent to what 12 to 15 axemen could do in one day's special work.

The auger is made by bending a bar of ¾-in. square tool steel in a spiral around a bar of 1½-in. round iron. The best distance for lead of spiral is 2½ ins. c. to c. The lower end is drawn into a chisel edge, which is widened to 1 3-16 ins. so as to clear both the inside and outside of the spiral. Great care has to be taken in sharpening the auger, as one stroke of the file will change the edge so as to make it quick or slow cutting.

The auger is fastened to the shaft by means of a thread and jam nut on its shank. The shaft is made in sections of 5 ft. 1¾-in. round iron. A keyway slot ⅝ in. wide and 3-16 in. deep is cut the length of the shaft. The revolving motion is transmitted to the auger by turning a crank fastened on the shaft of the driver of the bevel gearing; connections being made by means of a lug in the bore of the bevel pinion traveling in the groove of the shaft as it moves up or down.

An iron tripod 7 ft. high is placed on the frame. A line fastened to the swivel in top of shaft and passing through a block hung from top of the tripod is used to raise the auger the instant it cuts through the ice, and holds it up by passing a knot in the line into a U cleat. By holding taut on the line the auger is kept from binding when changing from snow ice to clear blue ice.

In the first machine the bevel gearing was 48 to 24, the diameter of the driver being 9 ins.; in the second machine, 52 to 17; diameter, 13½ ins.

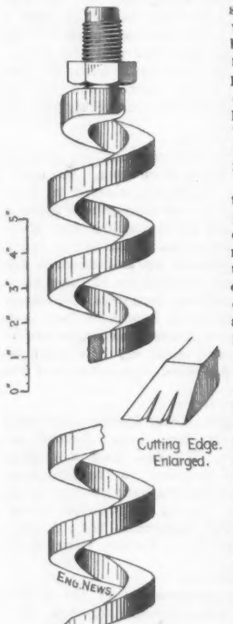
They would cut through 1 to 3 ft. of frozen snow and 24 to 30 ins. of ice in 8 seconds, 12 turns of the handle of No. 2 being necessary to 18 to 20 turns with No. 1, both being made in the same time; the greater speed of the latter being more fatiguing than the extra power required for the former. The two men operating a machine change places at the end of every line.

The time of beginning and finishing each line of holes was kept for each machine for two months. The average time per hole was for machine No. 1, 26⅝ seconds; machine No. 2, 25¾ seconds. All delays from time of beginning to quitting work for each day are included in the above. The best record made was 51 holes, 10 ft. apart, in 12 minutes, through 26 ins. of ice, or an average of one hole every 14.1 seconds. The same morning's work with that machine, No. 2, was 561 holes in 3½ hours. (The last day worked was April 5; 1,479 holes were bored with the two machines in 3½ hours.) It is much easier and quicker to sound through the bored holes than the chopped ones; also the sounding poles will last about five times as long as in the chopped holes. Frequently there was 6 to 18 ins. of water on the ice. At such times the work with the machines was not delayed, as it would have been if axes had been used to chop the holes.

Teeth were broken in both the cast iron gears during the extreme cold weather, 30° below zero.

For this winter's work we have three machines and the cut gears are of steel. No. 1 is 52 to 17, diameter of bevel driver 13½ ins.; No. 2 is 98 to 28, diameter of bevel driver, 12¼ ins.; No. 3 is 112 to 28, diameter of bevel driver 14¼ ins. It is expected that the gear of 3½ to 1 will give the greatest efficiency.

The party employed in making the ice surveys camp out in tents. The camp site is selected as near the work as possible, but on shore, where the tents will be well sheltered by the balsam trees. No fires are kept from 9 p. m. to 5 a. m. Fur overcoats are used in place of sleeping bags. The method used in making the surveys is as follows:



Auger for Ice Boring Machine.

The equations of the two lines parallel to and 250 ft. from the center line of the channel were computed, and the co-ordinates found of points every 500 ft. on each line, and the azimuths determined from two or more shore stations to the several points. In the field work, opposite points on the two lines are alternately located by lining in sight poles from two shore stations, signals being given by the transit men with red and white flags 6 ft. square. The transit intersections are marked with stakes placed in holes bored with ice augers. Intermediate stakes are set at the ends of the cross-sections by lining them in between the successive 500-ft. stakes, the distance between the cross-sections varying from 10 ft. for rockwork to 50 ft. for sand or clay.

Cross-lines of heaviest maitre cord, tagged every 10 ft., are stretched between corresponding stakes on the side lines; then holes are bored at each tag.

Soundings are taken with Norway pine or spruce poles, which are marked into feet and tenths of a foot. Quarter-hourly water gage readings are taken on a stake driven in shoal water 1 to 5 ft. deep. As the ice rises or falls with the changes of the water level, the zero of the gage should be referred every morning, by means of level readings, to some permanent bench mark ashore. It is a good plan to cover the stake at night with brush and loose snow. With the conditions the same as last winter, viz., from 1 to 5 ft. of ice, the average thickness being 26 ins., and the frozen snow 1 to 3 ft. deep, the following organization of the party would be the most efficient: One chief of party, who records the soundings, 2 men for sounding, 6 men to operate the three boring machines, 2 men to move the tag lines and mark the places where the holes are to be bored, 2 or 3 men to shovel the snow after the holes are bored, so that the sounders can see the water surface, 1 water gage observer and 1 cook.

The cost of such a party would be about $1,000 per month. An average of 3,000 holes could easily be made per day of eight hours. For 20 to 25 days' work per month the cost per soundings would be 1⅓ to 1⅔ cts. The soundings would be more accurately located and the cost less than surveys made from boats in the summer time.

* From the Proceedings of the Michigan Engineering Society for 1894.

WRECKING AND SNOW-CLEARING EQUIPMENT ON THE NORTHERN PACIFIC R. R.

In our issue of June 7 we pointed out the value to a railway of a good wrecking equipment and a systematic organization for dealing with train wrecks and other obstructions to traffic, and described the equipment and organization of four or five important railways. We give below some particulars of the wrecking and snow equipment, and methods of handling the same, on the Northern Pacific R. R., for which we are indebted to Mr. M. C. Kimberley, General Superintendent, and Mr. A. E. Law, Superintendent of the Minnesota Division.

The wrecking outfit on this division consists of a derrick car, tool car, truck car and blocking car, all equipped with air-brakes. The derrick is thoroughly trussed and has a lifting capacity of 20 tons. The truck car carries five freight car trucks of 40,000 lbs. capacity, one engine truck, and two pairs of 33-in. cast iron wheels with standard journals. The blocking car carries a full supply of hard and soft wood blocks, 200 oak wedges, and one small portable building for an emergency telegraph office. The equipment of the other cars is as follows:

Derrick Car.

1 truck line, 2½ ins. diam., 250 ft. long.	4 iron bound wedges.
1 truck line, 2½ ins. diam., 200 ft. long.	6 switch chains.
2 second-hand steel rails.	3 truck chains.
	2 wire cables, 1¼ ins. diam.

Tool Car.

Heating stove.	Pinch bars.
Hand saws.	Cold chisels.
Axes.	Clevises.
Adzes.	4 pairs rubber boots.
Wheel gage.	Pair patent frogs.
Steel wrenches.	Iron bound wedges.
Soft and chipping hammers.	Red flags.
	Red, white and green lanterns.
Track shovels.	
30-in. steel bars.	Oil and waste for packing.
12 torches.	6 baskets (grain), 2-bushel.
16-ft. ladder.	6 water pails.
Assorted sizes drift bolts.	Standard journal brasses and wedges.
Coupling links and pins.	
8-in. and 12-in. pony jacks.	12 assorted journal brasses for foreign cars.
Standard frogs.	
Switch chains.	2 hydraulic lifting jacks, 15 and 20 tons.
Torpedoes.	
Portable stretcher.	2 ratchet lifting jacks and levers.
2 gallons alcohol.	
Packing hooks and spoons.	A few hundred feet of spare 1-in. to 2½-in. guy lines and snatch blocks.
12 grain sacks, 2-bushel.	
Water barrel.	
Cross cut saws.	A small coil of telegraph wire and a few insulators and other telegraph supplies necessary to start an emergency office.
Hand axes.	
Sledge hammers.	
12 and 15-in. monkey wrenches.	
Spike mauls.	
3-in. rolling line.	A full set of edge-tools, the personal property of the foreman of the wrecking crew.
Picks.	
1 pair of climbers.	
Scoop shovels.	

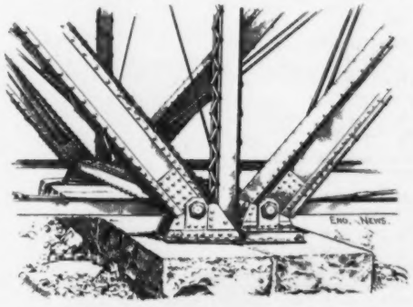
The wrecking gang is in charge of the foreman of car repairers, and a regular gang consists of eight men, who have regularly assigned duties and are thoroughly recognized. When a wreck is reported the foreman is first called; and the caller then calls one of the crew, who in turn calls another, and starts for the wrecking outfit. The second man calls the third and starts for the outfit, and so on until the crew is all on hand. By this system, in emergency, the crew has been on hand 15 minutes after the word was given. Work at night is done with the aid of six large torches, especially adapted to the purpose.

Snow Fences and Snow Plows.—The majority of permanent snow fence on the Minnesota Division is 9 ft. high, posts 8 ft. apart, with 8 boards 1 × 6 ins., and 6 ins. apart. There is also a considerable quantity of tight-board fence, 8 ft. to 10 ft. high, which is by far the most effective in heavy snow. The portable snow fence is after the "saw-buck" fashion, with legs 2 × 6 ins., bolted 2 ft. from the top, with a spread on the ground of 5 ft. 8 ins. The boards are spaced as in the first mentioned permanent fence. This fence is fastened to stakes driven in the ground. Snowdrifts up to 4 ft. deep are handled with pilot plows, unless too hard, in which case channels are cut across the track. The snow-bucking plows are of the wedge type, of which there are two designs, one having central deflecting wings, which throw the snow to each side of the track, and the other a single deflecting wing placed diagonally on the wedge portion of the plow and throwing the snow to one side of the track only. This wing is adjustable and used on either side at will. On double track the single-wing plow is found to be most useful. These plows are in all cases secured to the front of the engine, being bolted to a special wooden frame, taking the place usually occupied by the engine pilot, and are well secured to the smoke box at the rear end.

The snow flangers are operated by air. Two types of these flangers are secured to the pilot and work in combination with a shallow kind of snow plow wing, the flanging knives being secured at front or point of pilot and lifting at rear end only. Another device for flanging is in use on the rotary plows. This flanger is secured to the rear axle of the front truck by means of wrought iron bearings lined with brass, and engaging with the axle near the center of its length. The rear of the flanger is supported by connection with air apparatus, by which it is raised and lowered on an arc, the center of which is the truck axle at its front. It is found profitable to slope the cuts after "bucking" through them. The snow from the slopes is thrown into the center of the track, and a plow is then run through at high speed. This prevents the cuts from filling again until after one or two hard blows.

LOCATING EXPANSION ENDS OF BRIDGE SPANS.

A correspondent sends us a photograph, from which the accompanying perspective view has been made, illustrating the advisability of leaving plenty of room for motion at the expansion ends of bridge trusses. The structure illustrated is a deck highway bridge with spans of about 160 ft., and was erected last winter. The illustration shows the end shoes on one pier. The right-hand shoe is fixed. The left-hand shoe contains the usual arrangement of rollers. The bridge was erected in cold weather, and supposed ample space was left between the shoes on this pier. The movement of the roller end, however, as hot weather came on, shoved it closer and closer, and on June 2, when the photograph was taken from which our illustration was made, it was jammed tight against the fixed shoe. The end panel of the bottom chord was not only relieved from tension, but was under compression, so that the bars were sprung out of line from 4 to 6 ins. at the center. As the bridge is a highway structure, no noticeable harm has been done by this rather unusual condition, but a railway bridge might not be so fortunate; and we call attention to the incident in the hope that the lesson it teaches with reference to the possibility of trouble from this most unusual source may be of use to some of our readers.



A Lesson in Locating Bridge Seats.

CANAL OF THE WATER SUPPLY AND STORAGE CO., OF FORT COLLINS, COLO.

By F. T. Lewis, Assistant Engineer.

The canal just completed by the Water Supply & Storage Co., of Fort Collins, Colo., differs both in purpose and manner of construction from the majority of ditches heretofore built. The valley of the Cache la Poudre, being the part of the state first settled and brought under irrigation, is the locality in which the limit of the available water supply was first reached, with the result that the later constructed ditches experienced a scarcity of water in most years, and in years when the river discharges a less amount than ordinarily, an almost total failure. Becoming alarmed by several years of low water and partial failure of crops in consequence, the Larimer Ditch Co. several years ago began to search for some means of increasing its supply of water, and the Cache la Poudre and Laramie Rivers, having their sources near each other, and flowing for a short distance parallel, though on opposite sides of the mountain, the idea suggested itself of diverting the Laramie River, which flows north into Wyoming, and the waters of which are lost to Colorado, into the Cache la Poudre, from which the Laramie County ditch receives its supply.

Accordingly, in the summer of 1892, Mr. J. H. Nelson, an irrigation engineer, of Denver, was employed to investigate the practicability of constructing a ditch which should accomplish such diversion. (The writer served as assistant engineer to Mr. Nelson.) Surveys were made, and the project proving feasible, work was commenced with Carlisle & Weitbred, of Pueblo, Colo., as contractors. By reference to the accompanying sketch map, Fig. 1, it will be seen that Chambers' Lake is the source of the Cache la Poudre River, which lake is situated but little below and about 1,000 ft. distant from the top of the divide between the two rivers. The Laramie River heading much farther up country and draining quite an extent of territory, on which the snow melts late in the season, there is always during the irrigating season a flow of from 200 to 300 cu. ft. per sec. of time, which, when applied to land, is worth, at a moderate estimate, $1,000 per cu. ft.

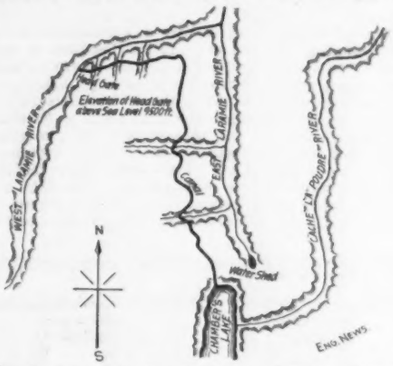


Fig. 1. Map Showing Location of Water Supply and Storage Co.'s Canal, Colorado.

The ditch, as built, is a little over four miles long, and there is an abundance of fall to accomplish the diversion, but the character of the route is such that only after extremely careful surveys was there a route found which was even possible, the sides of the mountain in many places being almost vertical precipices of rock, and in others covered with slides of detached masses of enormous size. These features necessitated numerous drops to pass below obstacles which could not be passed through. As economical construction rendered it desirable that the material obtained in excavating should be utilized in building a bank on the lower side of the ditch, the difficulty presented itself of retaining this bank in place. Owing to the steepness of the mountain, the toe of the slope would not be reached in many places till 500 ft. below. At such places a crib-work of logs was begun on the mountain side below the ditch, at a uniform distance of 25 ft. from it in a horizontal line, and carried vertically upward till it reached the line of the natural slope of the bank. The crib was then filled with coarse rock, etc., and lined on the side next to the water with fine earth, which, in some cases, had to be hauled for a considerable distance. Some of these cribs have been in place for two years and they have proved entirely satisfactory.

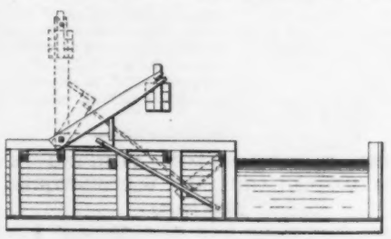


Fig. 2. Automatic Water Gate in Canal of Water Supply and Storage Co., Colorado.

This country being subject at some seasons to sudden torrents of water, it becomes necessary to provide some means of discharging the surplus water from the ditch, which was done by placing at suitable points automatic waste gates, similar to those which Mr. Nelson has used on numerous other ditches, and which have been tested by several years' actual use under severe conditions and have given entire satisfaction. They consist essentially of one or more gates in a frame structure at the side of the ditch, hinged at the top and opening outward. They are closed by a system of levers and a weight, which can be adjusted so that when the water rises above the height desired, the pressure is sufficient to open them, and, as the water is drawn from the bottom without check, the surplus is soon drawn off, when the weight closes them. By reference to Fig. 2 the details of operation can be more clearly seen.

The carrying capacity of the above ditch is about 200 cu. ft. per sec. and the cost was about $65,000.

The work was completed in November, 1893, and has been in successful operation during the irrigating season of 1894, discharging an average of 90 cu. ft. per sec., making it a profitable investment for the stockholders.

ALUMINUM BRONZE.*

Dr. John Percy, with that rare insight which characterizes the epoch-making man, described in a communication to the Royal Society, about 1855, an alloy of aluminum and copper which he called aluminum-bronze. The name has "stuck." The term "bronze" has been so variously used that I confess I do not know exactly what constitutes a bronze; but I know that in the great materials of engineering simplicity of composition is a cardinal excellence; and I wish to venture the suggestion that aluminum-bronze is not an alloy of aluminum and copper in any such sense as the compounds of tin and zinc with copper (except the copper-tin compound $SnCu_3$) are alloys. There are several reasons which lead me to this view.

In the first place, if a series of bars be prepared containing varying percentages of aluminum and copper, and the electrical conductivity of these bars be carefully determined, a curve of conductivity will be obtained. While I am not sure, at this time, that the values of conductivity shown in such a diagram are wholly dependent upon the percentage of aluminum added, the assumption is a probable one; and the curve indicates that an extremely small percentage of aluminum affects the conductivity in a ratio out of all proportion to the amount of that material. Another reason is drawn directly from experience in the foundry. If we take from the furnace a crucible containing melted aluminum and one containing melted copper, both at a little more than a red heat, and pour them together, the reaction is so intense that the metals are brought to a state of ebullition, the crucible becomes white hot from it, and you have evidence of intense chemical activity.

A third reason which I have for thinking that chemical union has taken place between the aluminum and the copper is that there is no known simple method of separating the aluminum from the copper when they have been thus combined. If you take a large billet of copper to which less than 10% of aluminum has been added, you can find no evidence whatever of the segregation of distinct granules of aluminum in copper, or of any uncertain composition, from one end of the ingot to the other.

There are reasons for supposing that the basal combination which is formed would correspond to the formula $AlCu_4$. That is what is commonly called 10% bronze. My belief is that it is an aluminide of copper and that its solution in copper gives us the various qualities of aluminum-bronze. To remedy some of the existing confusion in regard to the alloys of aluminum and copper I venture to propose that we consider this $AlCu_4$ as aluminum-bronze; that when it is diluted with an equal amount of copper we call it one-half aluminum-bronze; and so on to one-quarter bronze, etc. It is a common foundryman's idea that all the aluminum which can be taken up by copper is not in excess of 3%, and it is quite important that the nomenclature be clear and established at the beginning, because I see no limit to which the use of aluminum-bronze is not to go in the future.

As to the qualities of the compound which is formed in this way, it is at once evident, in view of the high melting-points of aluminum and copper, that if we have a true aluminide of copper formed, we have got a set of conditions, respecting corrosion, which does not exist in any alloy of copper. The combinations between copper and tin and zinc, and the very little understood relations which exist in manganese-bronze and that class of compounds, are very different from the action between aluminum and copper, and are not chemical

* By Dr. Leonard Waldo, Bridgeport, Conn., from a paper read at the Virginia Beach meeting of the American Institute of Mining Engineers.

unions at all; but in the case of aluminum-bronze you have a definite compound analogous in its mechanical qualities to a high-grade steel.

I take it that the steel people have virtually agreed that steel is a carbide of iron, and it is only a question of a solution of this in larger masses of iron. In an analogous way the aluminum-bronze is an aluminide of copper, deriving various properties from different degrees of its solution in the molten copper. This solution seems to be a very perfect solution. It is somewhat affected by the percentages of impurity in the copper. Aluminum is one of the most powerful deoxidizing agents known, and it is said that no oxygen can exist in the presence of molten aluminum. I think that must be modified to the statement that none can exist at very high temperatures. When the aluminum-bronze has been formed and when the chemical union has been effected between the aluminum and the copper, and in the absence of disturbing elements, we have a metal showing the fracture-qualities of the highest grades of steel and equalling steel in elongation, elastic limit and tensile strength, and possessing also a different class of properties. This series of metals is non-magnetic. They are very permanent. The oftener they are remelted the better they are, providing they are kept free from oxygen, iron and silicon. The value of the material is just as great after the tool has outlived its usefulness as it was at the beginning, and for all cases in which non-magnetic properties, or high conductivity, or extremely uniform and permanent behavior are required, you have the ideal metal.

One of the chief reasons why steel and iron hold their high value is the fact that they are commercially workable and the metal does not lose its mechanical properties throughout the range of the temperatures of ordinary use. Steel that is twice as hot as boiling water, for instance, is still excellent steel. That is not true of any of the alloys of copper made with tin or zinc; but it is true of aluminum-bronze.

We have been working in a quiet sort of a way, and rather on a toy scale as compared with the great steel plants of the country; but we have been trying to accumulate a little knowledge in our foundry work. We saw from the start that the fundamental question was the question of the ingot. There were plenty of rolling mills in the country where the ingots could be worked if furnished in uniform quality. I exhibit here some of the results of our work in this direction. We have been filling a number of specifications for the United States Engineer Department. The particular pieces, exhibited with this paper, are the hold-down bolts for the plates of mortar-batteries along the coast. This case requires a submerged bolt to take a strain of 200,000 lbs. per bolt, to remain years in place, and yet to afford a guaranty that at the end of years and after any number of firing-shocks that bolt shall be unchanged. I do not know of a severer test than that. Large forgings (hot) are accomplished in the same material.

We have been highly successful in the preparation of metal which will far surpass the present requirements for cartridge shells. I mention the cartridge shells because, as is well known, a cartridge is made from a flat disk, spun and swedged, and thus gives, perhaps, the severest test that we have of the complete working qualities of sheet metal.

The difficulties in casting aluminum-bronze are very great. I believe them to be more serious and perhaps less understood than those encountered in the casting of any known metal. The large contraction which takes place in the actual formation of the pattern-casting and the so far unexplained and unknown chemical actions which occur, have called for ingenious and complicated devices for obtaining sound castings. So far we have hesitated about undertaking castings weighing over two tons, and, of course, those are small castings in comparison with the work done in steel works at present.

The aluminum seems to have a wonderful capacity for occluding hydrogen gas, and the liberation of this gas at the moment of the union of the aluminum with the copper, and the unknown relation which hydride of copper may sustain to the oxygen which exists in the pores, present difficulties which have still to be thoroughly studied. In this manufacture, the purity of both aluminum and copper is of the utmost consequence. Those small percentages which almost defy the reagents of the analytical chemist become extremely important when one is working in the dark in regard to aluminum-bronze. In making up our crucible charges we cannot depend upon the chemical formulas only, because we must take careful account of the loss and the destructive combinations which take place between aluminum and silicon and iron.

In a perfect ingot or casting, the solution of aluminum-bronze and copper seems to be perfect. The analysis from the top, bottom and sides shows no variation due to segregation. Of course, the mechanical mixture must have been made complete, so as to secure both the chemical combination and the uniform solution of it in excess of copper.

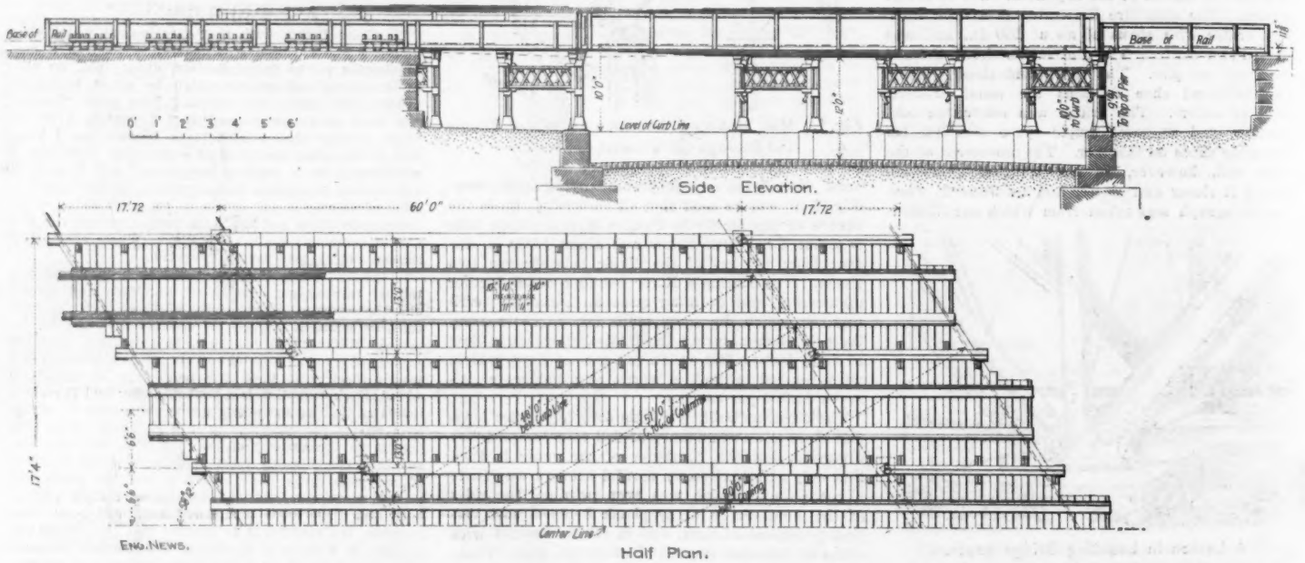


FIG. 1. ELEVATION AND HALF PLAN OF ARCHER AVE. SUBWAY UNDER CHICAGO, ROCK ISLAND & PACIFIC AND LAKE SHORE & MICHIGAN SOUTHERN RAILWAYS; L. H. Clarke, Chief Engineer of Track Elevation Work.

NEW 30,000,000-GALLON PUMPING ENGINES, PHILADELPHIA WATER-WORKS.

(With inset.)

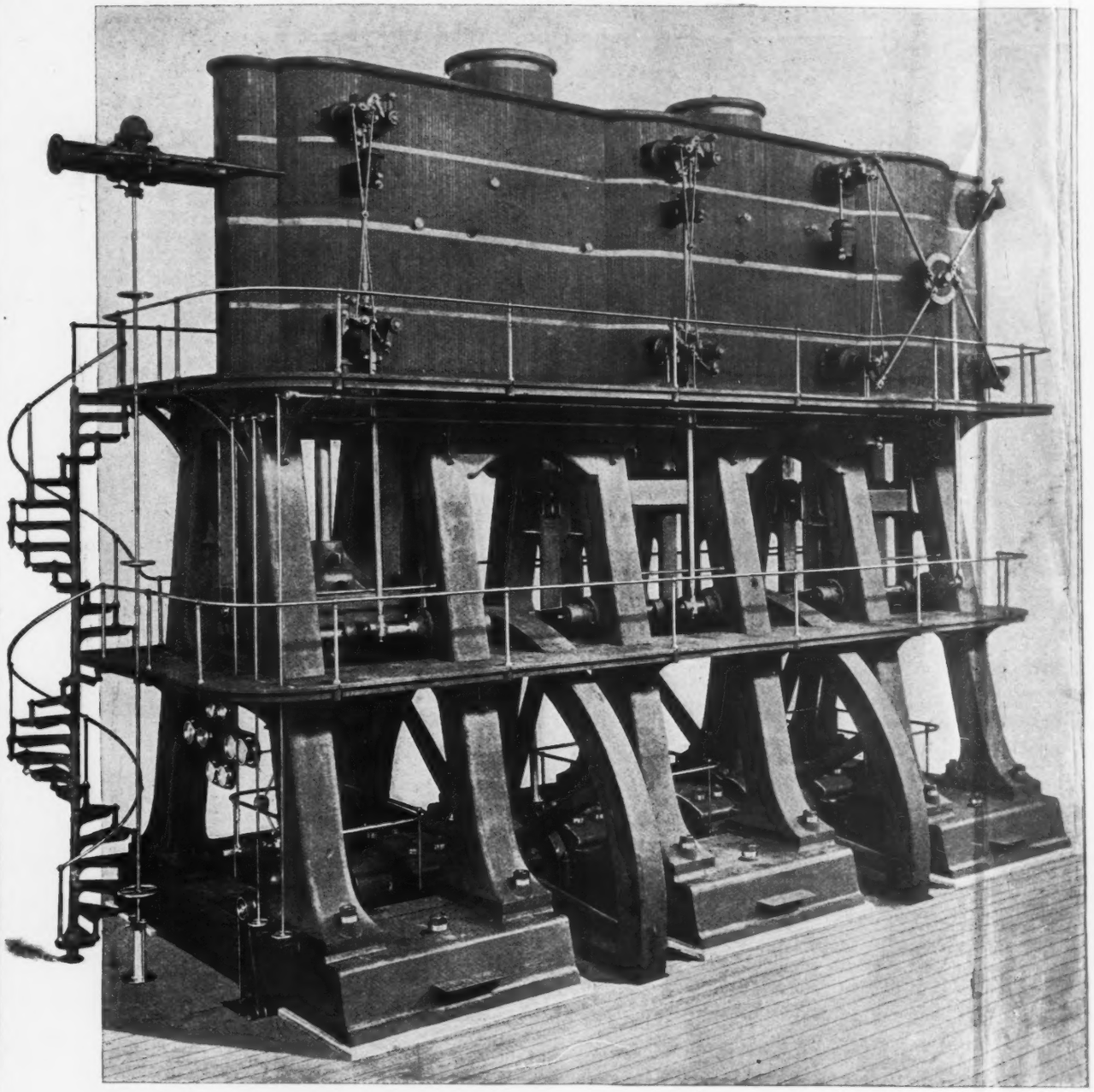
We show on our inset sheet this week a perspective view and elevations of a 30,000,000-gallon pumping engine, which has the distinction of being the largest pumping engine now in operation on a water-supply system in the world, so far as our information extends. Two of these engines have been recently installed by the Holly Manufacturing Co., of Lockport, N. Y., in the Spring Garden station of the Philadelphia Water-Works. The steam cylinders are 36 ins., 62½ ins. and 92 ins. in diameter, and the pump plungers are each 30 ins. in diameter, with a uniform stroke of 60 ins. The pump plungers are double-acting and are outside-packed.

As seen by the drawings, the steam cylinders are mounted on top of heavy cast iron frames, resting on massive cast iron bedplates, while the pump chambers are placed directly below, between the masonry walls on which the bedplates rest, and are supported on a solid rock foundation. Each pump plunger is rigidly connected to the steam piston directly above it, the connection being made by four steel distance rods, extending between the upper cross-head, to which the piston rod is attached, and the lower cross-head, to which the plunger rod is attached. The upper cross-heads carry slide plates, which work in vertical guides formed in the frames, and carry also the wrist-pins to which the connecting rods from the crank shaft are secured.

The engine has two main shafts, each of which carries a heavy flywheel. Each shaft has a crank on each end, and the inboard cranks of each shaft are connected by a heavy steel pin to which the connecting rod from the intermediate cross-head is attached. The three cranks are set 120° apart, thus securing a very uniform flow in the suction and discharge pipes. The shafts are of forged steel and are 17½ ins. in diameter at the bearings and 19 ins. between the bearings. The bearings are 27 ins. in length, and are lined with composition metal. The two flywheels are each 19 ft. in diameter and weigh 30 tons. Reheating receivers are placed between the high-pressure and intermediate cylinders, and also between the intermediate and low-pressure. The reheating coils take live steam from the boilers on their interior.

The steam valves are of the Corliss pattern, and are so located in the cylinder heads that the clearance spaces are reduced to less than 1½%. The valve-motion permits the steam to be cut off at any point of the stroke, and the cut-off in any cylinder may be adjusted independently of the cut-off in another. The cut-off gear can be controlled automatically either by a pressure regulator, when the pumps are delivering directly into the mains, or by a speed governor, when it is delivering water to the reservoir. The volume of the low-pressure cylinder is about 6½ times that of the high-pressure, and the steam is expanded from 18 to 25 times its initial volume in its passage through the cylinders. All the steam cylinders are steam-jacketed and clothed with non-conductors covered with black walnut lagging. An independent air pump and a jet condenser are located on the floor of the engine room, and the injection water is raised by the suction of the condenser from the main supply pipe.

The head against which these engines work is 145 ft., and the steam pressure is 140 lbs. at the engine throttle. The dimensions over all are: Height from pump foundation to top of steam cylinder, 60 ft.; length, 42 ft.; width, 20 ft. The pump valves are circular rubber valves of the ordinary pattern. The suction and force mains are



PERSPECTIVE VIEW.

VERTICAL TRIPLE-EXPANSION PUMPING ENGINE,

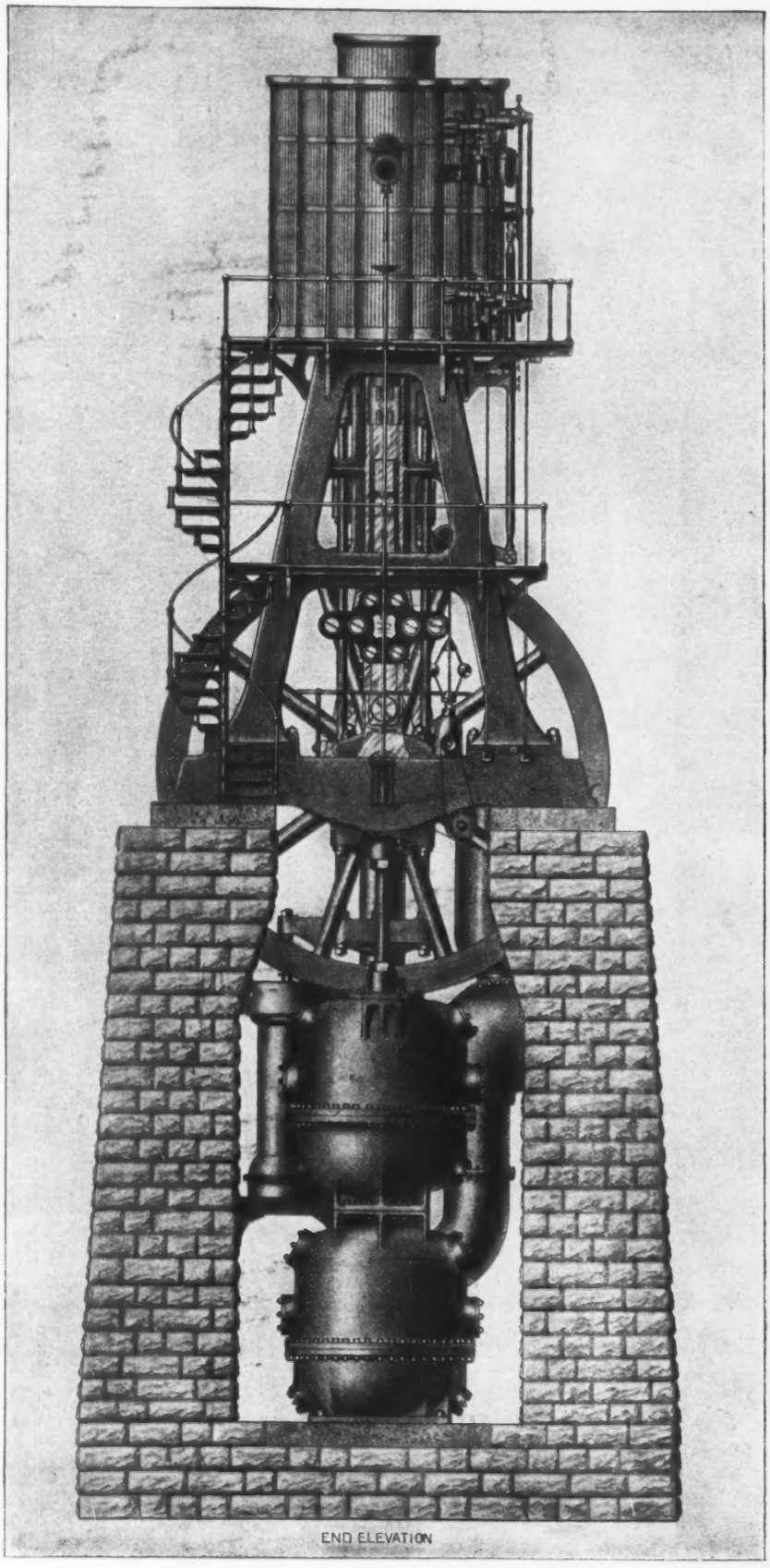
AT SPRING GARDEN STATION,

PHILADELPHIA WATER-WORKS.

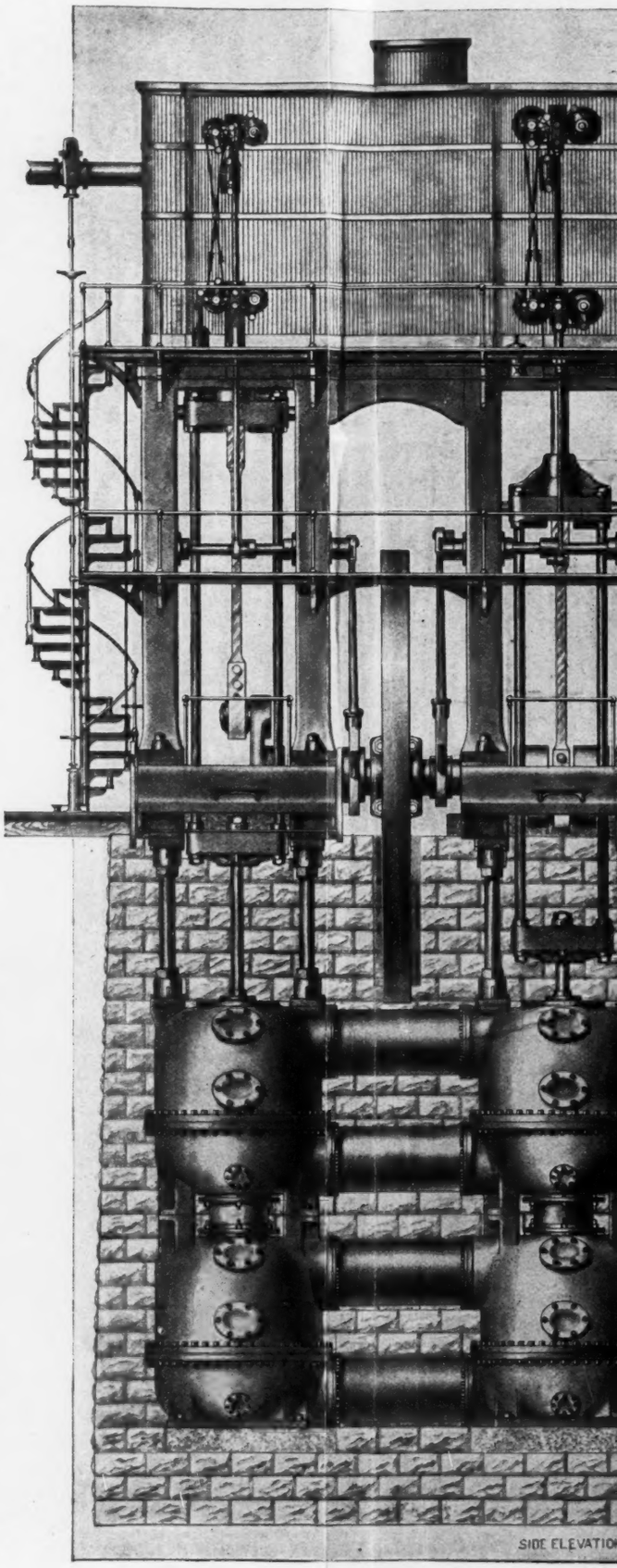
Daily Capacity, 30,000,000 Gallons.

Designed and Built by

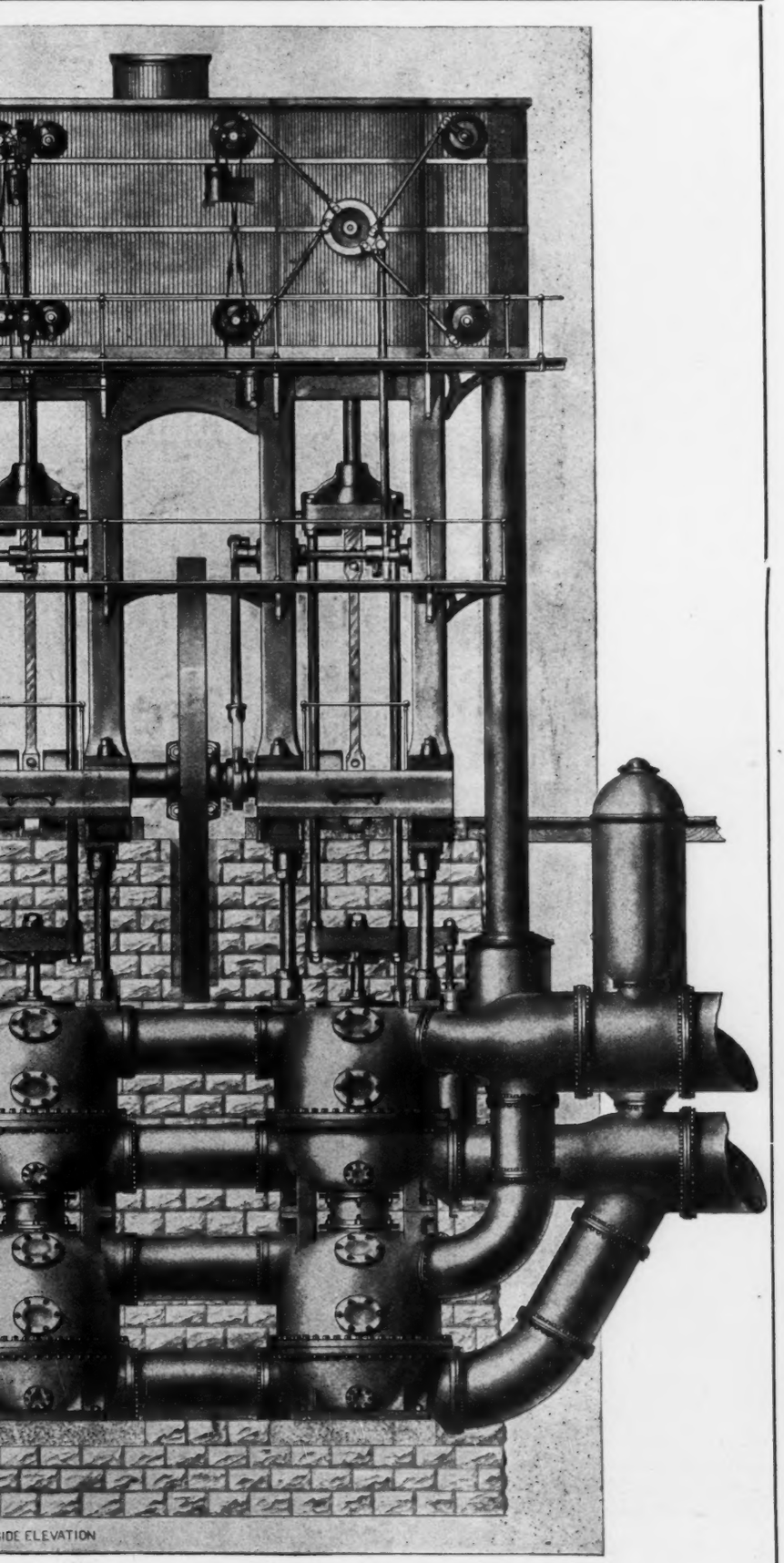
The Holly Manufacturing Co., Lockport, N. Y.



ELEVATION OF HIGH PRESSURE END.



ELEVATION



IDE ELEVATION

LEVATION OF FRONT OF ENGINE.

each 48 ins. diameter. The air chamber on the force main is kept filled by an automatic air charger.

When delivering water at their rated capacity the engines will run at 20 revs. per minute, which is equivalent to a piston speed of 200 ft. The contract for the engines was awarded to the Holly Manufacturing Co., on June 30, 1893, and the engines were to be completed by Sept. 30, 1894. The work on them has been somewhat delayed, however. The engines are guaranteed to show a duty on contract trial of 125,000,000 ft. lbs. per 1,000,000 heat units in the steam received.

We understand that the Holly Manufacturing Co. stands ready to build pumping engines similar to those erected at Philadelphia, with capacities up to 50,000,000 gallons per 24 hours. They have recently secured the contract for three 36,000,000-gallon sewage pumping engines for the city of Providence, as noted in our issue of Sept. 27. The Providence engines, however, will work against a low head, so that their actual power will be much less than that of the Philadelphia engines.

THE ARCHER AVENUE SUBWAY, CHICAGO, ILL.

We illustrate herewith the general structural details of the subway underneath the tracks of the Chicago, Rock Island & Pacific and Lake Shore & Michigan Southern railways at the crossing of Archer Ave., in the city of Chicago. Of the 38 subways which are made necessary by the elevation of the tracks of these two roads, this is the first to be put under construction. Its general design will be followed closely in the structures at 22d and 23d streets, and possibly at the remaining crossings, although this last is by no means certain. The ordinance requiring the elevation of these tracks specified that the crossings over the streets should be of iron or steel, with masonry abutments, and should have solid floors or be provided with devices to carry off storm water and prevent any dripping into the streets below. (Eng. News, April 26, 1894.) The manner in which the railway companies have carried out the specification is shown by the drawings.

Fig. 1 shows an elevation and part plan of the subway. It is a five-track plate girder, through bridge, crossing the street on a skew of 58° 12', and giving passage underneath to a 60-ft. roadway and two sidewalks each 19 ft. wide. Separate girders span the roadway and the sidewalks. Those over the roadway are supported on steel columns at each end, and those over the sidewalks have one each resting on the columns and the other on a 14 × 15 × 3⅞ in. bedplate, bolted to the masonry of the abutments. The adjacent ends of the sidewalk girders and the roadway girder are riveted together through their vertical end stiffeners. There are six lines of girders, spaced 13 ft. apart c. to c., and between them run the five railway tracks. The several drawings in Fig. 2 show the main structural features of the girders, columns, flooring, etc.

As stated above, the side and center girders are riveted together at their adjoining ends vertically over the columns, and they rest on a cast iron block bolted on the top plate of the column. The girders are bolted to the column tops and the floor is riveted to them with at least six rivets at each connection. The columns are placed upon stone pedestals, which are carried down to the foundations and extend far enough above the sidewalk to bring the ironwork well above any danger of surface water. Each pair of columns is braced together by vertical, lattice truss bracing.

The floor is made up of rectangular troughs built of plates and angles, and similar in all respects to the trough floor used on the New York Central & Hudson River R. R. (Eng. News, Nov. 16, 23, Dec. 7, 1889, April 13, Aug. 31, 1893). Its depth is 10½ ins. and the troughs are spaced 21 ins. apart c. to c. The troughs are made up as follows: Top plate, 10 × 7-16 in.; side plates, 9⅝ × ⅜ in.; bottom plate, 11¾ × 7-16 in.; angles, 3 × 3 × ⅜ in. The flooring fits between the lower chord flanges of the girders, with a clearance of 1 in. on each side for drainage, and its underside is on a level with the underside of the lowest chord cover plate. It is reinforced at the ends and provided with plates and angles which rest upon the vertical leg of the chord angles, and rivet to the web of the girder without any interference with the chord rivets. At the columns the flooring rests upon the top plates of the columns, but it also has the regular attachment to the web of the girder, and, in addition, at two intermediate points of the roadway girders, namely, near each end of the last cover plate, the underside of the flooring and the underside of the chord plate are connected by a 7-16-in. splice plate, with eight rivets. A similar connection is made near the abutment end of each of the sidewalk girders. The floor is also stiffened against the girders with gusset plates and angles riveted to the top plate of the troughs and the vertical web stiffeners. At the abutments the floor finishes up as shown in Fig. 2, the bottom plate resting upon a ⅝-in. wall plate bolted to the masonry.

Upon the floor and riveted to it through reinforcing angles on each side of every trough are the rail plates under each rail. Details of these rail plates and the manner of fastening the rail to them are shown in Fig. 2. The outer guard rail, consisting of a 4 × 3½ × ½-in. angle-iron is a detail that is especially noteworthy, and still more deserving of study is the plan proposed of laying the rail directly on the steel plate with no wood cushion intervening.

Gutters for catching the drip are placed under each girder. These gutters are 1 in. deep in the center over the roadway, and slope at about the same rate as the surface of the street to a depth of 6 ins. at the columns, and similarly, over the sidewalks, they slope from the abutments as the highest points to meet the gutters over the roadway at the columns. At each column there is a 2-in. leader, with a spout turned to spill into the street gutter.

All the metal work is of first-class steel, conforming in quality and workmanship with the specifications of the Lake Shore & Michigan Southern R. R. for structural steel. The abutments are of dimension stone masonry. The ironwork illustrated was designed by Mr. Albert Lucius, M. Am. Soc. C. E., of New York city. Mr. L. H. Clarke, of Chicago, is the engineer in charge of the track elevation work. We are indebted to Mr. Clarke for the matter from which our illustrations and this description have been prepared.

A description of the large subway constructed to carry Sacramento Ave. under the tracks of the Chicago & Northwestern Ry. was published in our issue of Sept. 21, 1893, and a much smaller subway, designed for foot passage only, underneath the tracks of the Boston & Albany R. R., at Franklin St., Boston, Mass., was described in our issue of July 12, 1894.

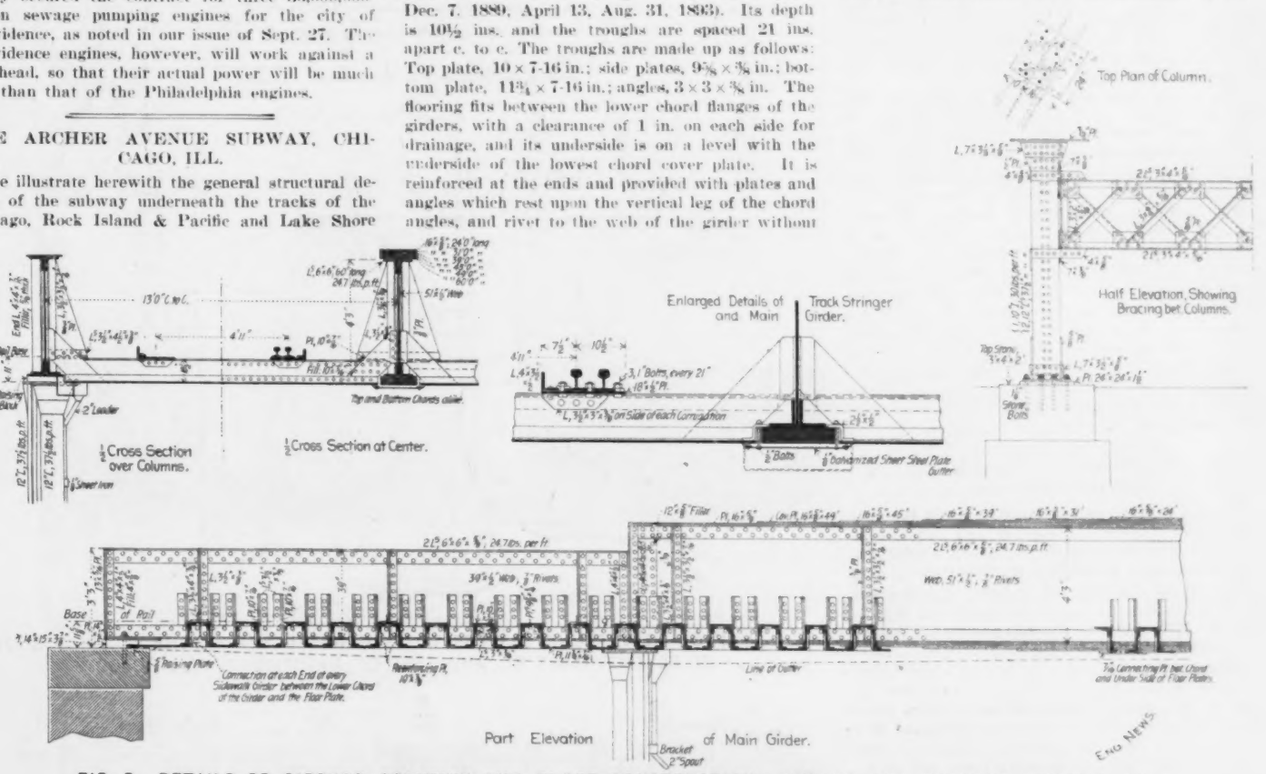

½ Cross Section over Columns.
½ Cross Section at Center.
Enlarged Details of Track Stringer and Main Girder.
Top Plan of Column.
Half Elevation, Showing Bracing bet. Columns.
Part Elevation of Main Girder.
Bracket 2" Spout
Line of Gutter
Connection at each End of every Sidewalk Girder between the Lower Chord of the Girder and the Floor Plate.
Top and Bottom Chords alike.
Sewer Iron
Base of Rail
Line of Gutter

FIG. 2. DETAILS OF GIRDERS, COLUMNS AND FLOOR CONSTRUCTION; ARCHER AVE. SUBWAY, CHICAGO, ILL.

LEGAL DECISIONS OF INTEREST TO ENGINEERS.

Streams of Water as Boundaries.

Where a stream of water is the boundary line of a tract of land, and it suddenly abandons its channel, and makes for itself a new course or bed, by cutting across a neck or bend, the Supreme Court of Nebraska holds, in the recent case of Bouvier v. Stricklett (59 Northwestern Reporter, 559), that the middle of the old channel or bed of the stream still constitutes the boundary line of the tract of land, although it may be dry, or no water flowing therein. But where the middle of the channel of a stream of water constitutes the boundary line of a tract of land, and the water undermines the banks, and the soil "caves in," and mixes with the water and is washed away, the owner of the land must stand the loss, and the middle of the new channel formed for the river by such process, if a new channel is thus formed, will constitute the boundary line of the tract of land.

Neglect to Remove Grounds on Electric Circuit.

The Supreme Court of Arkansas holds that the giving of punitive damages is warranted where it was known at the power house of an electric company at 2 a. m. that its wires were grounded somewhere; that the superintendent was informed of this; that he gave instruction that the power be kept up, and that after daylight, about 6 a. m., when many people were on the street, a live wire still lay on a crossing at a street; contact with the same caused the death of a passer-by.—Texarkana Gas & Electric Light Co. v. Orr, 27 S. W. Rep., 66.

THE HANYAN ROLLING MILLS, CHINA.

The Hanyan rolling mills, of China, says U. S. Consul Jacob T. Child, are now approaching completion at Hanyan, opposite Hankow. The plant covers 70 acres, with 1½ miles of railway. This plant, which was designed by an English engineer, includes four very large blast furnaces, two heavy steam hammers and all the rolls and other machinery for turning out railway rails. Large quantities of Chinese iron are on hand, and coke is being imported from Wales for fuel. The estimated expenditure on the plant is $3,500,000, and it will require another million to complete it.

According to Mr. Child, it is the intention of the Viceroy, Chang-Taz-Tung, as soon as these works are in operation, to manufacture rails, machinery, small arms, etc. The arsenals are almost finished, and machinery will soon be set up for making arms and munitions of war. The two buildings devoted to this department cover an area of about four acres, and so far only the best material has been used throughout.

The mines from which comes the iron ore used by the furnaces are near Wang-Shih-King, 76 miles from Hankow and 16 miles inland at Tayeh. A well-constructed railway connects them with the river. Both hard and soft coal is found in this neighborhood, but it is mined in the crudest manner, with no attempt at systematic drainage. When a mine is flooded, it is abandoned and a new one is opened. This coal is said by experts to be unsuitable for smelting, as it contains too much sulphur. It is believed, however, that both coal and iron of excellent quality can be obtained by developing these mines on modern methods. The rails made here are to be used on railways which will connect Hankow with other roads projected in the interior. This information is under date of March 19, 1894, and the effect of the Corean war upon the undertaking is, of course, not given.

THE WENTWORTH AVENUE TRUNK SEWER, CHICAGO.

The city of Chicago has recently begun the construction of a system of sanitary and storm-water sewers which will cost approximately $3,000,000, and which, when completed, will drain all of that portion of the city bounded by Lake Michigan and the Calumet River on the east and south and by Halsted and 77th streets on the west and north. Within this territory are included Pullman, Riverside, East Washington Heights and a half-dozen other towns which were brought into the city of Chicago by some of the various annexation acts which have added 140 sq. miles to the city since 1889, and also all that large tract of sparsely settled territory lying west and north of Calumet Lake and river, which a score of years ago was little better than a swamp and is now largely given up to truck farms upon which the city streets are gradually encroaching as the population moves south. Except perhaps the solitary instance of Pullman, none of these small towns have had anything in the shape of a sewerage system save a few box sewers and drains, and, in fact, nothing more was very urgently needed; but as the population rapidly increased after annexation these temporary expedients became unsatisfactory and the city has been compelled to undertake the construction of a system of trunk sewers which would serve as a basis for the complete sewerage system of a thickly populated section of the metropolis. It is one of these trunk sewers the construction of which we illustrate.

Before beginning the description of the work now in progress, however, a brief description of the general scheme, so far as it has been definitely decided upon, is necessary. For the purpose of sewerage the territory before described has been divided into seven main drainage districts, the sewers in three of which, viz., Woodlawn, 70th St., and 73d St., are completed and in operation. The work remaining to be done is divided into four districts, designated as the 83d St. district, the 95th St. district, the Indiana Ave. district, and the Wentworth Ave. district. The sewers thus far decided upon in each of these districts are shown by the accompanying map. Work is now in progress on the Wentworth Ave. system and the assessments for the others are now pending in the courts.

The Wentworth Ave. sewer drains West Pullman. Its mouth is at 130th St., where it has a diameter of 10½ ft., and where it empties into the Calumet River. It extends from this point north on Wentworth Ave to 99th St., at which point the inside diameter is 7 ft., thence west on 99th St. to Halsted, and north on Halsted to 88th St., making a total length of 6½ miles. Its diameter at its upper terminus is 5 ft. A branch leaves Wentworth Ave. at 103d St., and beginning with a diameter of 5½ ft., goes west on 103d St. to Charles Ave., 600 ft. east of Ashland Ave., northwest in Charles Ave. to 95th St., west to Evergreen Ave., north to 94th St., west to Prospect Ave., north and northwest to 87th St., making a total length of 3¾ miles. The inside diameter at the upper terminus is 2 ft. 6 ins. Both the main sewer and the branch are being constructed this year; and the flow throughout will be by gravity, no pumping station being required.

The 83d St. drainage district takes in the territory between Halsted St. and Lake Michigan from 75th to 87th Sts. A pumping station is required in this district to pump the sewage from the delivery well into which the sewers discharge into an outlet pipe which empties into the lake. This system contemplates four main sewers, with a total length of about 15 miles, and the total cost, with the

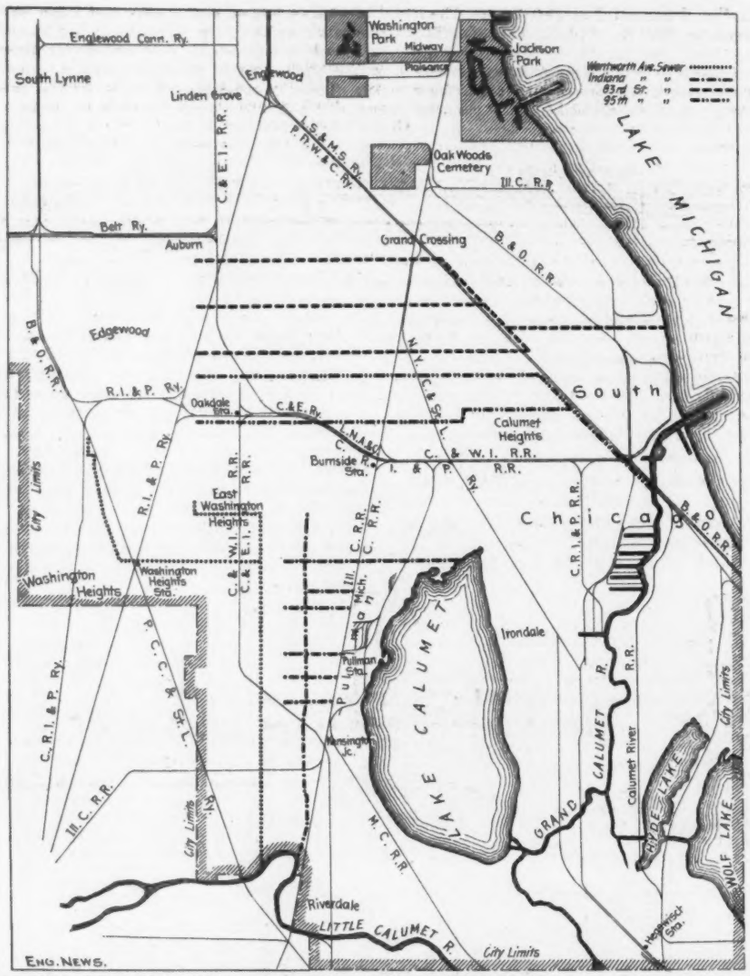


FIG. 1. MAP OF NEW TRUNK SEWERS TO BE CONSTRUCTED IN THE DISTRICT SOUTH OF SEVENTY-FIRST ST. AND EAST OF HALSTED ST. IN CHICAGO.

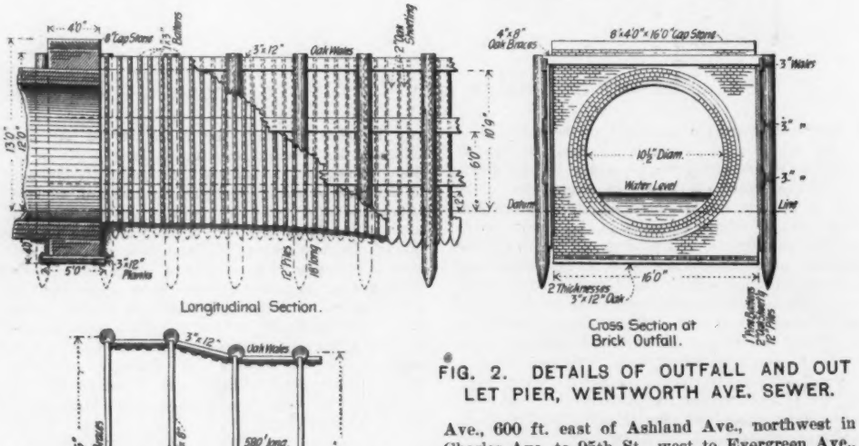


FIG. 2. DETAILS OF OUTFALL AND OUT LET PIER, WENTWORTH AVE. SEWER.

pumping station, is estimated at $1,021,000. There will be sewers in 77th St., 81st St. and 85th St., all running from Halsted St. to South Chicago Ave., and a fourth in South Chicago Ave., connecting the other three and a sewer in 83d St. from South Chicago Ave. to the lake. The pumping station will be built at the corner of 83d St. and Mackinaw Ave.

The 95th St. district comprises the territory from Halsted St. to the Calumet River between 87th and 97th Sts. This district is to have two main sewers, a pumping station and outlet. The estimated cost is $873,000. There will be a sewer in 87th St. from Halsted St. to Anthony Ave., in 91st St. from Halsted St. to Stony Island Ave., thence north to 90th St. and east to Anthony Ave.; also in Anthony Ave. from 87th St. to 95th St., and thence to the Calumet River, where the pumping station will be built. The diameter of these sewers varies from 9 ft. to 2 ft., and their total length will be 18½ miles.

What is known as the Indiana Ave. district extends from the Calumet River at 130th St. north to 99th St., and lies east of the Wentworth Ave. district. It differs from the others, as it is designed for drainage purposes for removing storm water instead of house sewage. There will be one main sewer in Indiana Ave. between the points named, which will take house drainage and also the surface water collected by the lateral sewers. Of these there are six, to be constructed of brick and tile, in 103d St., 105th St., 107th St., 111th St., 113th St. and 115th St., as shown by the map. This work is estimated to cost $225,000.

As stated above, construction has begun only upon the Wentworth Ave. system. Here, owing to the great depth of the cut, which varies from 47 ft. to 20 ft. for a distance of 3 miles, and the treacherous nature of the ground in places, special methods had to be adopted in carrying out the work. The masonry of the sewer terminates at a point about 550 ft. north of the bank of the river. At this point the ground makes an abrupt decline to the low level of the slough which in wet weather borders the river. This slough is crossed by a timber channel, as shown in Fig. 2, in which the sewage flows into the river. Of course, in case the extension of the city ever requires this low ground to be filled in, the masonry of the sewer will have to be extended to the river. From the outlet the sewer runs directly north along the line of Wentworth Ave., with an inside diameter of 10½ ft., and here within the first mile from the river the deepest cut and most difficult ground are encountered. The contractors for this portion of the work are Messrs. Wilson & Jackson, whose offices are at 1537 Monadnock Block, Chicago.

Machinery is used almost entirely for making the excavation and also for doing the back filling after the sewer is completed. The general arrangement of the plant used is shown by Fig. 3, which is drawn from a rough sketch made on the ground and with little attention to accurate scale. It shows, however, the method of doing the work. As will be seen, two steam shovels are used. Shovel No. 1 removes the top soil to a depth of from 25 ft. to 30 ft. above the bottom of the sewer and loads it on a train of flat cars running on a track laid along one side of the sewer and connecting with the Illinois Central R. R. This material is of course not used at all for back filling. When this first excavation is finished the pile driving begins, and for this purpose a portable pile driver with a swinging frame follows close behind Shovel No. 1. This pile driver is shown in Fig. 4, and to the left of it on the bank is shown the pile puller, which draws the piles after the masonry has been completed, if in the judgment of the city's engineers their removal will not bring too great a pressure on the green masonry. The same view also shows the depth of the cut made by the first shovel, which, it will be noted, is not very deep here. At points this cut was 25 ft. deep.

Two rows of oak and Georgia pine piles from 20 ft. to 30 ft. long are driven about 16½ ft. apart. The piles in each row are spaced about 3 ft. c. to c. and are driven to a depth well below the bottom of the sewer. After driving, the piles are capped with 12×12-in. pine timbers, and on these steam shovel No. 2 rests, being moved on rollers when necessary. This shovel excavates the remaining depth of the sewer between the piles; i. e., two or three feet below the bottom of the sewer.

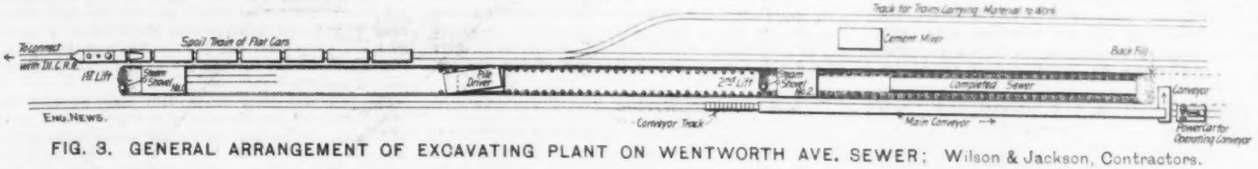


FIG. 3. GENERAL ARRANGEMENT OF EXCAVATING PLANT ON WENTWORTH AVE. SEWER; Wilson & Jackson, Contractors.

FIG. 4. VIEW OF PILE DRIVER AND PILE PULLER, WENTWORTH AVE. SEWER, CHICAGO.

It is in this second lift that the most difficulty has been encountered. The material in the deepest cuts here was a soft, sticky, blue clay, and it was found that as the excavation deepened the sides exerted an enormous pressure on the rows of piles, tending to crush them together. So great was this pressure in places that the iron extensible sewer braces which were used often buckled like straws. It should be mentioned that a strong plank lagging was put on the outside of the piles as the work progressed.

The material from shovel No. 2 is dumped onto a conveyor about 300 ft. long which runs on a track parallel to the sewer, as indicated in Fig. 3. This conveyor carries the material back to the rear of the brick-work and dumps it onto a cross-conveyor or apron, which in turn dumps it into the trench, completing the back filling. Only one handling of the material is thus necessary in the whole process of excavation and back filling. The operation of the steam shovel in connection with the conveyor is quite clearly shown in Figs. 5, 6 and 7. Two endless chains pass over pairs of sprocket wheels at the ends of the conveyor frame and carry between them a series of scrapers (Fig. 7), which ride close to the floor of the conveyor. This floor is of course stationary and the dirt is dumped onto it and scraped or shoved along by the scrapers. As the material arrives at the end of the main conveyor, it falls upon a cross conveyor or apron, exactly similar in construction and operation, which dumps it into the trench. The system of chains is operated from a power car at the head of the conveyor. Referring to

FIG. 5. VIEW SHOWING STEAM SHOVEL AND CONVEYOR IN OPERATION, WENTWORTH AVE. SEWER, CHICAGO.

Fig. 5, the tail of the conveyor is shown with the shovel at work depositing earth on it. Fig. 6 is a smaller scale view of the whole system. The flight of scrapers in the main conveyor is clearly shown, but the position and operation of the apron is in a great part hidden by the telegraph pole in the foreground.

Regarding the operation of the conveyor, little is to be said, except that it is perfectly satisfactory for the work it has to do. This, of course, does not at all press the capacity of the machinery,

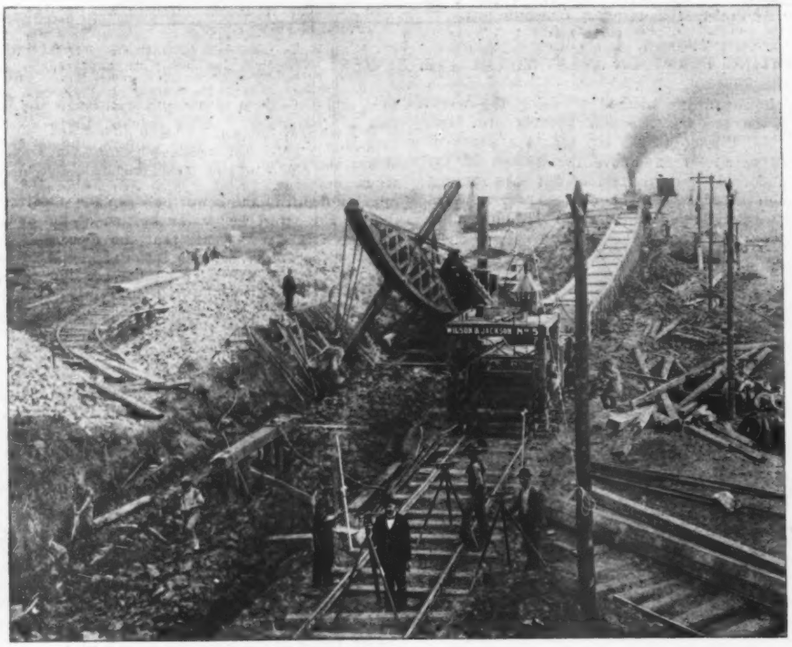


FIG. 6. GENERAL VIEW OF CONVEYOR PLANT, WENTWORTH AVE. SEWER, CHICAGO.

since the excavation proceeds but little more rapidly than the masons can build the sewer. In fact, the machinery is often idle. The idea of using the conveyor system is due to the contractors, Wilson & Jackson; the apparatus being designed by Mr. Jackson.

A section of the brick masonry which forms the sewer is shown in Fig. 2. It is circular, 10½ ft. in diameter inside, and consists of four rings of brick laid in cement mortar. The sand for the mortar has been thus far obtained from the excavation, and it is screened, washed and mixed with

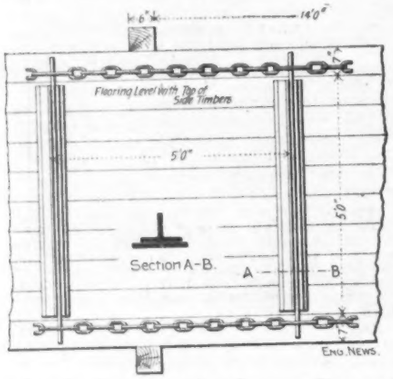


Fig. 7. Sketch Detail of Conveyor Floor and Scrapers.

the cement by machinery. All the brick, cement and other material used in constructing the sewer are brought by train along the side of the sewer trench and dumped close to the work.

The entire work is being carried out under the direction of Mr. A. W. Cooke, Chief Engineer Department of Sewers, with Mr. N. D. Pound, Assistant Engineer, in direct charge for the city. We are indebted to these gentlemen and to the contractors, Wilson & Jackson, for the matter from which our illustrations and this description have been prepared.

CURVATURE OF DIAMOND DRILL HOLES.*

By J. Parke Channing.

In the winter of 1892-93 the writer was doing some exploring on one of the Michigan iron ranges in which the ore formation was so deeply covered with drift of a wet and sandy nature that test pitting was out of the question. On the hanging wall side was quartzite, and as the formation stood nearly upright it was determined to sink at various intervals sand shafts to this quartzite, about 250 ft. beyond the line of contact of the quartzite and the formation; and then, by a series of fan holes, test this formation. From the first pit, ledged at some 30 ft. and sunk in the ledge 17 ft., nine holes were drilled, testing the formation for a length of over 500 ft. and to a considerable depth.

Knowing the strike of the formation and its approximate dip, he was considerably surprised, when drilling hole No. 3, to find that the stratification of the quartzite cores did not agree with the supposed strike, dip and angle of the hole. Concluding that the hole must have changed its angle, he determined to test it, and knowing that hydrofluoric acid had been used for that purpose he procured a bottle of a 20% solution of that acid, and getting some pieces of ⅞ in. combustion tubing, made some test tubes 5 ins. long. In one of these he poured 2 ins. of the hydrofluoric acid, put in a rubber cork, and having blocked the bit with a plug of wood, introduced the corked tube in the core shell, screwed the core shell on the core barrel and lowered the rods to the bottom of the hole.

This hole had been started at an angle of 45° and was then down 531 ft. 6 ins. The time occupied in lowering was 30 minutes. The rods were left in the hole 90 minutes, and it took 45 minutes to pull the rods out. The hydraulic pressure at the bottom of the hole had forced the rubber cork down in the tube, compressing the air, and inside was a very mixed-up mess of a milky liquid. Examination showed, however, a well-defined elliptical ring of adherent crystals which, when holding the tube in the proper position, coincided with the water level. This ring was not, however, continuous, because of the cork having been forced down so deep in the tube.

Laying the tube on one edge of a geological clinometer and tilting the clinometer and tube till the water and crystal line were coincident, 30° was easily read, showing that the hole had flattened 15° in the 531.5 ft. The results of this test were so encouraging that we sent to Elmer & Amend and had made a dozen special tubes 1 in. diameter, 5 ins. long, with ground glass stoppers.

Hole No. 4 was now down 175 ft., having been started at an angle of 45°. The writer sent down one of the new tubes, taking the precaution to drive a wooden plug in the core barrel so that the water in the rods would not have a tendency to force the tube out while pulling up. This was lowered in 15 minutes, left down two hours, pulled up, and the tube found filled with liquid, whereas only about 2 ins. of mixed acid and water had been put in. The hydraulic pressure had worked in through the ground glass joint and diluted and filled the tube.

The test was tried again, this time blocking the core barrel and the bit each with a dry wooden plug, and making small gaskets for the joints between the bit, the shell and the barrel. It had the same results, however, the water having worked its way through the fibers of the wooden plugs, and the test was again spoiled. After trying a couple of the old style rubber combustion tubes and getting only fair results, one of the special tubes was taken and, before putting in the acid, heated, and at the same time the stopper was dipped in melted paraffine. The acid was then put in, the stopper with its film of melted paraffine quickly pressed in, and the tube inserted in the core shell. This tube gave the first clear and distinct test. It showed 35° at a depth of 175 ft. From that time the use of the tube became very simple. It was found that ample time could be taken to pour in the acid, affix the stopper and insert the apparatus in the core shell. The foreman had no difficulty in making the tests.

The final method of work was as follows: A blank tube was put in the combined bit and core shell from the top end until the lower end rested on the spring. Holding this in position, it was laid beside the core barrel so that the length of thread was allowed for, and a file mark made on the core barrel just even with the top of the glass stopper. A dry wooden plug was made to fit the core barrel and driven in till it just cleared a point corresponding to the file mark. The core barrel was now clamped in a vise in a nearly vertical position.

The stopper of the tube was held in a tin spoon with a little paraffine over a candle flame, and the upper end of the tube warmed. An inch of 20% hydrofluoric acid was carefully poured in the tube, then an inch of water, and the stopper taken from the melted spoon of wax, smartly rapped to throw off any excess of paraffine, and quickly put in the tube. The acid immediately heated up the tube, but no ill effects were felt from this. Wrapping a thread or two of lampwicking around the neck of the tube, it was put in the core shell and, still holding it in an upright position, the upper end was introduced into the core barrel and the thread between the shell and the barrel screwed up. Carrying the barrel in an upright position it was put down the hole, and no special pains taken in lowering down the rods, save to touch the bottom of the hole carefully.

Several experiments were made as to the time necessary to leave the tube in the hole, and showed that 2 hours was as good as 24. One hour did not give very good results. The churning up of the acid in going down the hole did not in the least affect the test, and the result was generally clear.

When the tube came out of the hole it was tried before taking the stopper out, making the liquid coincide with the line of crystals. Then the stopper was removed, the crystals cleaned out, fresh water put in, and the angle again tried, using for a guide that portion of the glass which had been etched by the acid.

In order to see if the rods would really turn when bent at angles as shown by the above record, the writer connected together 50 ft. of Sullivan E rods, whose external diameter is 1.1315 ins., being made of double thick pipe. Curving this so that the depth of the arc was 6 ft., he had no difficulty in "tonging" the rods with a pipe wrench. This curvature was much greater than that found in the holes.

There is one point, however, which he failed to determine, and that is the amount of lateral deviation of the holes, if any. If the country had been totally free from local attraction, there would have been no difficulty in sending down in the core shell a small compass mounted on a universal bearing, with a tripping arrangement to set it when the bottom of the hole was reached and the needle quiet. The dip of the hole was tested every 100 ft., and thus a fair idea was obtained of the work. On some of the deep holes the point was 50 ft. higher up and 50 ft. further away from the collar of the hole than if it had gone straight.

In looking about to discover why the holes flattened, the writer remembered that about the last part of hole No. 2 he put in a new core barrel. These core barrels when new are 1½ ins. diameter, but after use wear down to 1¼ ins. at the upper end. The bits

*Abstract of a paper read before the Lake Superior Mining Institute.

used were 1 17-32 ins., and the clearance of the stone 1-64 in. on each side, so that the gage of a new bit was 1 17-32 + 2-64 = 1 9-16 ins. It is quite evident that with an old core barrel 1½ ins. diameter at its upper end and a bit 1 9-16 ins. at its lower end, and this bit constantly kept up to gage, we have a 10-ft. tapered boring tool. The weight of the rods and their pressure produce a tendency for the upper end of this tool to rest on the bottom of the hole, and thus in a distance of 10 ft. the line of tool is 5-32 in. out from the line of the hole in which the tool rests.

Hole No. 9 at the first pit mentioned was also drilled by Mr. R. H. Channing, and he succeeded in keeping it straight by using 1½-in. blank bits with but little clearance and a new core barrel. The work of the nine fan holes was done with an "S" drill of the Sullivan Machinery Co., and the hole near Amasa by an "E" drill of the same make. The cost of drilling the first 2,091 ft. at the fan-hole pit was as follows, the cost including everything, from the time the pit was left in shape for the drill to go down, and including also running a No. 7 pump to keep the water out:

Labor on drills	$0.606
Firemen	.206
Fuel	.182
Camp account	.722
Repairs on drills, bits, core barrels, etc.	.126
Repairs on boilers and machinery and sundry supplies	.007
Carbons	.229
Superintendence	.106
	$2.374

NEW PUBLICATIONS.

(Any book noticed in this column of which the price is given will be sent postpaid by Engineering News Publishing Co. on receipt of the amount stated. This does not include publications issued by the Government, by states or cities, by societies, or trade publications. For copies of these, application should be made direct to the address given in the notice.)

MODERN METHODS OF SEWAGE DISPOSAL for Towns, Public Institutions and Isolated Houses. By Geo. E. Waring, Jr., M. Inst. C. E. New York: D. Van Nostrand Co. London: Sampson Low, Marston & Co., Ltd. 12mo; cloth; pp. 252; 22 illustrations; $2.

Those who desire to have in a condensed form a discussion of the principles involved in the sanitary disposal of sewage, according to the most recent practice, will find Colonel Waring's little book very useful to that end, and at the same time very entertaining. Few engineers, to say the least, can write so pleasantly and clearly as this author, and few in this country have devoted more time than he to studies of the subject in hand, especially where small towns and isolated buildings, great or small, are concerned.

The book is devoted to a discussion of methods and principles, rather than to a description of actual works carried out. Such references to existing sewage disposal works as are made serve principally as examples introduced to illustrate the discussion and generally deal with works designed by the author. All the methods of disposal in vogue in this country are described and discussed and the well-known Massachusetts experiments are reviewed. The author is a firm believer in disposal on land, either by irrigation or filtration, but, notwithstanding this, the longest chapter in the book is devoted to chemical treatment. In fact, this one chapter out of 18 comprises about 50 pages, or one-fifth of the whole book. Credit for the arrangement and completeness of this chapter is given to Mr. G. Everett Hill, Colonel Waring's secretary.

In concluding the book the author makes the following statement regarding the purpose of his work:

> The purpose has been not so much to give specific information to engineers as to inform the public at large, and especially those whose official positions, as members of Boards of Health and of committees of councils, etc., bring them face to face with the practical sanitary problems which present themselves in all communities, and which become more and more serious as the work of removing liquid wastes by sewers progresses.

As Colonel Waring points out, there is but little popular knowledge on this important subject, and consequently but little demand for the best methods of disposal. Unfortunately, communities and individuals seeking advice from those supposed to be posted in methods of sewage disposal often engage a man whose knowledge does not cover the whole subject, and who is commercially interested in some particular method of treatment. With these facts in mind the value of a popular presentation of the subject, written in a very readable style, will be obvious. A committee whose members have read this book will be in a large measure prepared to meet an engineer and understand his explanations of local conditions and his discussion of the methods best designed to meet these conditions at the lowest cost consistent with the best sanitary results.

It must not be inferred from the above quotation or from what has been said that this book will not be useful to engineers. No engineer can read the work without being benefited by it. Those engineers whose practice is in other lines of engineering, and who have not had occasion to study sewage disposal, can spend a few very pleasant and profitable hours over this book, and post themselves on a subject concerning which every engineer, and indeed every well-informed man nowadays, should have a fair degree of knowledge.

ENGINEERING CONSTRUCTION IN IRON, STEEL AND TIMBER. By Wm. Henry Warren, M. Inst. C. E., M. Am. Soc. C. E., Professor of Civil and Mechanical Engineering, University of Sidney, N. S. W. London, 1894: Longmans, Green & Co. 8vo; cloth; pp. 372; numerous illustrations; $5.

This is one of the most satisfactory text-books on statics which has come to us in some time, both in its typography and general make-up, and in the concise and readable manner in which the author has treated his subject. It is herein that the chief merit of the book lies, for an examination shows little that is new in methods or treatment, according to English practice, unless perhaps it may be the unusually large number of practical examples of bridge work which are illustrated and worked out. This, however, is a feature new rather to English text-books in this department than to American, as the elaborate works of Du Bois, Johnson and Merriman testify.

Chapters I. and II. appropriately open the subject by describing and discussing briefly the ordinary methods of testing iron and steel and wood, and the practical application of the results of such tests in designing works. In Chapter II., devoted to timber tests, are given some interesting figures relating to the much discussed jarrah, ironbark and gum timbers of Australia. Transverse tests made by the author on ironbark timbers 6 ins. × 4 ins. × 4 ft. span show a modulus of rupture of 18,000 lbs. per sq. in., while that of several other timbers runs from 12,000 to 16,000 lbs. He states, however, that Australian timber is liable to rot at the heart. The average life of timber bridges is given as 25 years.

Chapter III. discusses the resolution of forces and the application of the principle to bridge work, and is followed by chapters on bending moments and shearing stresses in beams and girders. Chapter VI. begins the distinctly practical part of the book by describing and illustrating modern practice in designing small span timber and iron viaducts, timber trestles, etc. Several examples of pile trestle are shown, presumably Australian structures, which possess some features, especially in the floor construction, which could be adopted with advantage by American engineers. The floors here shown have the cross-ties spaced 9 ins. apart in the clear (which is very much too wide, as 4 ins. should be the maximum), with every second tie bolted to the stringer, and the whole capped by a 6 × 6-in. guard rail bolted to the stringer through the ties, alternating with those first noted. It may be said in passing that the author recommends the use of the Engineering News formula for calculating the bearing pressure and safe load of piles.

In the remaining chapters are discussed the best methods of calculating the stresses in various common types of structures and the several practical examples of bridges calculated and designed complete in all their details, which have been referred to. Perhaps the most noticeable thing in this part of the book is the very considerable attention given to American practice in bridge construction. The design of pin-connected bridges peculiar to American practice is described, and a 180-ft. pin-connected span is worked out in detail. In all of this part the text has been made as brief as possible, and the illustrations are depended upon for more complete explanation of details. The volume closes with a short but fairly good index.

GENERAL SPECIFICATIONS FOR ROOFS AND IRON BUILDINGS. By Charles Evan Fowler, Assoc. M. Am. Soc. C. E., Chief Engineer, Youngstown Bridge Co. New York: Engineering News Publishing Co. Folio; pp. 6; 25 cts.

This is the second edition of these specifications, now somewhat enlarged. Especial attention is paid to snow loads and wind pressure. For the first, the snow load in pounds per square foot of horizontal projection and for roof pitches varying from 1 to 2 to 1 to 6, is given for five groups of states, covering the whole United States. Tables for wind pressure follow, and then come formulas for weight of covering and trusses and unit strains for iron, soft and medium steel, with various sections and under varying conditions of stress. Directions are given for spacing purlins, carrying corrugated irons and for proportioning and arranging the iron itself. These specifications include ventilators and louvres, lighting, details of construction, workmanship, quality of material to be used, painting and erection. Definite specifications are given for the size of lacing and design of columns subject to bending. The steel specifications require soft or medium steel, with not more than 0.085% phosphorus; an ultimate strength of from 52,000 to 60,000 lbs.; an elastic limit of one-half this, and an elongation of not less than 25% in 8 ins. All medium steel is to have punched holes reamed, or is to be drilled. All iron or steel framing and all corrugated iron, unless galvanized, is to have one coat of pure lead paint before leaving the shop, and all surfaces in contact are to have one heavy coat, and all parts difficult of access after erection are to have two coats of red lead paint at the shop. These specifications are much reduced in bulk and made plainer by a simple system of marginal reference, by number of line, to other sections having a bearing upon the line thus referenced. Another novel and useful feature is an index, badly needed in all specifications, with those clauses of most importance to the estimating department designated by bold-face figures. This new and more complete edition of these specifications has been prepared in response to the extended demand for the first edition by engineers and architects, and it is being used in several technical schools.

STRESSES IN GIRDER AND ROOF TRUSSES. For Both Dead and Live Loads by Simple Multiplication, with Stress Constants for 100 Cases. By F. R. Johnson, Assoc. M. Inst. C. E. London. 1894: E. & F. N. Spon. 12mo; cloth; pp. 215; 28 plates; $2.50.

The purpose for which this little manual was designed is perhaps best explained by the author. In the preface he states that as "most practical engineers and draftsmen" have "little time to spare for mathematical investigation and calculation," the majority of text-books upon the subject of stresses in bridge and roof trusses are "too abstruse." Therefore, "in this work an attempt has been made to simplify matters" by giving the "stress constant" for each truss number for 100 cases, "which only require to be multiplied by the panel load to give the maximum stress in any member." These 100 truss diagrams and tables of stress constants, with a few pages of directions, compose the book, which, perhaps, has its place in engineering literature. The "practical engineer and draftsman," however, whose knowledge of mathematics does not extend to the point of calculating the stresses in simple bridge and roof trusses with uniform loads is hardly the person to design such structures, even with the aid of a "simple multiplication" method. We fear that the "long-felt want" which the book is intended to supply exists only in the author's imagination.

WOODEN TRESTLE BRIDGES—A Treatise on, According to the present practice on American railways. By Wolcott C. Foster. Second revised and enlarged edition. New York: John Wiley & Sons. 4to; 216 pp.; many illustrations; $5.00.

The author omits mention in his preface of the particular points enlarged upon in the new edition; but a comparison with the first edition shows that almost every chapter has some additional matter, taken from later practice and from recent articles in the technical journals. Many new details connected with pile-driving are illustrated and described; formulas for the safe bearing-power of piles are given in full in this edition, together with some instructive pile-driving records; the chapter on pile-drivers is extended by plans and description of jet-pile-driving; rail-spiking to prevent creeping of rails is treated upon, as is also trestle-building upon curves, and two entirely new chapters are added, upon timber suitable for trestle-building and upon theoretical considerations of design. Under the head of Standard trestle plans some new designs are also added. The result of this latest effort of Mr. Foster is undoubtedly a most valuable work upon a subject upon which there was little previous literature. It is a thoroughly practical and eminently useful book for engineers.

TRANSITION CURVES. A field-book for Engineers, containing rules and tables for laying out transition curves. By Walter G. Fox, C. E. Van Nostrand Science Series, No. 110. New York: D. Van Nostrand Co. 16mo; boards; pp. 80; 50 cts.

The author lays down simple rules for running these curves, following the methods usually employed for running circular curves. After explaining and illustrating the method, problems are laid down and worked out. The bulk of the book is devoted to tables for use in the work.

THE HYDRO-GEOLOGY OF THE UPPER MISSISSIPPI VALLEY and Some of the Adjoining Territory. By Daniel W. Mead, Member of the Western Society of Civil Engineers. Reprinted for private circulation from the "Journal of the Association of Engineering Societies," vol. XIII., No. 7, July, 1894. 8vo; paper; pp. 68; tables, maps and folding inset sheets.

A note, written before this reprint came to hand, setting forth the general scope of Mr. Mead's excellent paper was published in Engineering News of Oct. 4, 1894.

PAPERS READ BEFORE THE ENGINEERING ASSOCIATION OF THE SOUTH. Hunter McDonald, Secretary, Nashville, Tenn. 8vo; paper; pp. 99; illustrated; 25 cts.

This volume contains the following papers: "The Pecos Viaduct," by Julius Kruttschnitt; "Cumberland Park Race Course," by Walter G. Fitzpatrick; "Mining Interests of Nova Scotia," by Frank Cawley; "Mechanics as a Fine Art," by Wm. T. Magruder, and "Triangulation System of River Surveying," by Walter G. Fitzpatrick. There is also the address of the retiring president. The first paper is accompanied by plates showing the details of construction of the viaduct and the trestles used in its erection.

ROPE DRIVING.—Practical Notes on. By M. E. Reprinted from the Street Railway Journal. New York. 8vo., pamph., pp. 48; 50 cts.

Commencing with the early history of rope-driving, about 1830, the writer treats of the make and strength of ropes, gives tables for working stress on different sizes, and then discusses the friction, tension, pulley-grooves, etc. The horse-power of ropes, with a table of rope-power constants, take up the next chapter, and then follow chapters on the weight and speed of ropes and tension, due to centrifugal force, the length of drive and forms of pulley-grooves, the relative merits of the continuous and separate systems of rope-driving, the splicing and care of ropes, and the cost of ropes. With the latter chapter is a table of practical examples of driving with separate ropes of cotton, giving the amount of power transmitted, and diameter, number, speed and driving force of the ropes.

FOREIGN RAILWAY OWNERSHIP AND OPERATION.—Interstate Commerce Commission. E. A. Moseley, Secretary. Washington, D. C. 8vo; paper; pp. 16.

This report was prepared in consequence of a Senate resolution calling for information as to government ownership and operation of railways in foreign countries, and contains such information as was on hand at the time, and is therefore somewhat incomplete. It is hoped, however, to publish another report later, containing all the information obtainable. Of 34 governments listed, 10 do not own or operate railways, 2 own and operate all their railways, 18 own and operate some of the railways, and 3 own some of the railways but lease them to private companies for operation. Ten pages are devoted to quotations from various writers on the subject.

GAS AND PETROLEUM YIELDING FORMATIONS OF THE CENTRAL VALLEY OF CALIFORNIA. By W. L. Watts, M. E. San Francisco: State Mining Bureau. 8vo; paper; pp. 95; illustrated.

This publication, issued by the State Mining Bureau, under the supervision of Mr. J. J. Crawford, State Mineralogist, has been prepared by Mr. W. L. Watts, Assistant in the Field. It enters fully into the geological features attending the occurrence of natural gas, and gives the results of experiments made to ascertain the value of the gas as fuel, from which it is shown that 1,000 cu. ft. of gas are equal to 45.3 lbs. of carbon, or 50 lbs. of coke carrying 10% ash. Improvements in machinery for drilling deep wells, introduced by Mr. W. E. Youle, are also described. Copies may be obtained on application to the Bureau, by sending 3 cts. for postage.

MANUAL OF SURVEYING INSTRUCTIONS FOR THE SURVEY OF THE PUBLIC LANDS OF THE UNITED STATES AND PRIVATE LAND CLAIMS. Prepared in Conformity with the Law, under the Direction of the Commissioner of the General Land Office.—Department of the Interior. Washington, D. C. Public Document; 8vo; cloth; pp. 236; plates and maps

This volume of instructions gives full and minute directions for the execution of surveys in the field, including the operations of chaining, marking lines, etc., and the use of instruments. There is also a specimen of the method of keeping field notes. There are nine plates and three maps.

TRADE PUBLICATIONS.

HOWDEN HOT DRAFT SYSTEM FOR LAKE STEAMERS.—Detroit Dry Dock Co., Detroit, Mich. 12mo; pp. 16; illustrated.

This hot-draft system was first introduced on the lakes on the twin-screw passenger steamer "Virginia," effecting a saving of one-third in fuel consumption by enabling a steady steam pressure to be maintained with a cheaper grade of coal. In the Howden system, hot air is supplied to closed ash-pits.

THE CATTLEGUARD PROBLEM. Together with the Laws of Cattleguards and Railroad Fences, Containing Statutes and Decisions of the States of the Union. By Benjamin Reece, C. E. The Q. & C. Co., Chicago. 8vo; pp. 70.

The discussion of the cattleguard problem occupies 14 pages, and is devoted to a consideration of its practical and legal aspects, while the superiority of surface over pit cattleguards is made clear. The rest of the book is occupied by references to the several state laws respecting railway fencing and injury to cattle, together with decisions rendered under these laws. It thus forms a very useful and handy compilation for the use of railway officers and others.

GERMAN ASBESTOS GOODS.—Louis Wertheim, Frankfort-on-Main, Germany. Ed. Wertheim, Agent, Chicago, Ill. 12mo; boards; pp. 75; illustrated.

The great variety of uses to which asbestos and asbestos goods are now put need not be explained to engineers. Considering the extent of its present use, however, it is somewhat surprising to find that asbestos from the famous Canadian mines was first used for commercial purposes only as far back as 1876, and that its production has increased 20,000% in 18 years, nearly 10,000 tons per year now being mined. Nearly 75% of all the asbestos produced comes from the Province of Quebec, Canada, and much of this is manufactured in Germany by the firm whose name is given above, and which practically owns the mines. In a little pamphlet just issued by the representative of the firm in this country is described some of the more important materials manufactured from asbestos, and which run from Corliss engine cylinder packing to "theatrical snow." There is much in this little book which will interest engineers.

PERSONALS.

Mr. B. J. Saunders has been appointed Town Engineer of Brockville, Ont.

Mr. R. S. Pratt, Assistant General Superintendent of the Southern Pacific Ry., at San Francisco, Cal., has resigned, after 30 years' service.

Mr. W. S. Monroe has opened an office in the Rookery Building, Chicago, and will practice as a mechanical and electrical engineer.

Mr. J. H. Warder has opened an office at 1429 The Monadnock, Chicago, for carrying on a general practice as a consulting and contracting engineer.

Mr. Charles C. Parsons, M. Am. Inst. Min. Engs., of Boston, Mass., Consulting Engineer for the Boston & Montana Smelting Co., died at Spokane, Wash., Oct. 5.

Mr. George Pandeley, President of the Whitney Iron Works, New Orleans, La., died Oct. 8, at the age of 66. He was formerly Superintendent of the Morgan Line Ry.

Prof. Edward M. Boggs, in charge of the department of civil and hydraulic engineering of the University of Arizona, has been appointed territorial irrigation engineer.

Mr. F. S. Thompson has been appointed General Superintendent of the Chesapeake, Ohio & Southwestern Ry., to succeed Mr. G. J. Grammer, who had the title of Assistant General Manager.

Mr. J. W. Alvord, M. Am. Soc. C. E., has opened an office in the Rookery Building, Chicago, for the practice of civil engineering, making a specialty of water-works and sewerage systems.

Capt. Phillip M. Price, M. Am. Soc. C. E., U. S. Engineer Corps, died suddenly Oct. 4 at Fort Monroe, Va., of lung disease. He was born in Pennsylvania in 1848 and graduated from West Point in 1869.

Prof. Thomas C. Mendenhall, late Superintendent of the U. S. Coast Survey, has returned from Europe, and on Oct. 5 assumed his new duties as President of the Worcester Polytechnic Institute, at Worcester, Mass.

Mr. George E. Gifford, Assoc. M. Am. Soc. C. E., has removed from the King Bridge Co.'s office at Cleveland, O., to 18 Broadway, New York city, and while still retaining the title of Engineer of the company will take charge of its Eastern office.

Mr. Ralph Modjeski, Assoc. M. Am. Soc. C. E., announces that his partnership with Mr. E. W. Nickerson, under the name of Modjeski & Nickerson, has expired by limitation, and that he will continue his business as civil engineer at his office, 760 Monadnock Building, Chicago.

Mr. George M. Angleman, of Plainfield, N. J., died Oct. 6 at Matawan, N. J. He was born in Plainfield in 1823. For many years he held the office of Street Commissioner, and superintended the construction of part of the Central R. R. of New Jersey and the laying out of the towns of Fanwood and Dunellen.

SOCIETY PROCEEDINGS.

ENGINEERING ASSOCIATION OF THE SOUTH.—The regular monthly meeting was held at headquarters in Nashville, Tenn., Sept. 13, Major Lewis presiding. There was an informal discussion as to the best and cheapest culverts for areas under 50 ft.

Hunter McDonald, Secretary.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.—At the meeting on Oct. 1, Mr. Woodman opened the discussion on his paper on "Transition Curves." He briefly reviewed the somewhat complex work of Prof. C. L. Crandall. Other members spoke of personal experience with the easement curve. It was decided that the discussion should be continued at the November meeting, and the remarks should be reduced to writing and arranged for publication.

C. L. Annan, Secretary.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—At the meeting on Oct. 3 the paper on "The Improvement of the Myrtle Ave. Line of the Brooklyn Elevated R. R.," by Mr. O. F. Nichols (Eng. News, Oct. 4), was read and discussed. The following list of officers for the coming year was presented by the nominating committee: President, George S. Morison; Vice-Presidents, Desmond Fitzgerald and Benjamin N. Harrod; Secretary, Othniel F. Nichols; Treasurer, John Thomson; Directors, George H. Brown, George S. Benzenberg, Robert Cartwright, Fayette S. Curtis, Augustus Mordecai and Charles Sooysmith. It was announced that the letter ballot on amendments to the constitution had resulted in the adoption of the amendments. This of course makes void the nomination for Secretary, as one of the amendments is to the effect that the Secretary shall be appointed by the Board of Direction.

ENGINEERS' CLUB OF ST. LOUIS.—At the meeting on Oct. 3 Mr. N. M. Eayrs gave an informal talk on the power house of the new union station, located about 1,800 ft. south of the head house. The steam plant consists of four 250-HP. Babcock & Wilcox boilers, with revolving chain grates. The latter cost $1,000 per boiler, and have proved entirely satisfactory, particularly in abating the smoke. The steam is used to operate three Buckeye tandem compound engines and two air compressors. The engines are direct-connected to Siemens-Halske generators, which operate at 500 volts, and whose output is distributed by the five-wire system, permitting the operation of both arc and incandescent lamps. The compressors furnish air for the interlocking plant, which is the largest in the country, and with which 240 train movements were recently made in a single hour. The station is heated from this plant, the pipes being laid in a conduit about 1,800 ft. long. The indirect system is used in the main building. Air is taken in at the top of the tower by two fans in the subcellar, and passed over steam coils. Each fan is driven by a 40-HP. motor. Direct radiation is used in the offices.

Mr. J. A. Laird then presented the results of some experiments recently conducted by the water department to determine the efficiency of various forms of steam pipe covering. Chemical analyses were first made of each covering. Tests were then made—first, by noting the condensation per hour in a 10-ft. length of 1-in. pipe, to which the covering had been applied 1 in. thick; and, second, by filling the same pipe with steam, and after closing all valves, noting the time which elapsed before the pressure gage fell to zero. The first test resulted as follows:

Material.	Condensation, cu. cm.
Magnesia, plastic	334
" sectional	335
Asbestos fire felt	367
" sponge molded	371.3
Plaster of paris and sawdust	438
Asbestos sponge cement	604.5
Bare pipe	1085.

The second test confirmed these figures. The initial steam pressure was 30 lbs. Prof. Kinealy called attention to the fact that these experiments agreed well with previous investigations, which had shown that the best coverings reduced the condensation to about one-third that in the bare pipe.

Wm. H. Bryan, Secy.

WESTERN SOCIETY OF ENGINEERS.—The regular meeting was held at the Grand Pacific Hotel Oct. 3. The larger part of the session was devoted to the reading of papers, one entitled "Notes on a Broken Pinion Shaft," being presented by Mr. Onward Bates, and the other, "General Hydraulic Features of the Chicago Main Drainage Channel," by Mr. T. T. Johnston, Principal Assistant Engineer, Sanitary District of Chicago. The first paper described briefly the failure of a 3 7-16-in. rolled wrought iron pinion shaft for operating a two-track swing bridge over the Menominee River on the Chicago, Milwaukee & St. Paul R. R. This shaft broke directly across in two places about 5 ins. apart and inside a cast iron sleeve. The short 5-in. piece was found split into quarters almost as a straight-grained wood would split. It was found that the shaft was operated by a gear having about 1 in. lost motion, which caused a shock each time the shaft was put in operation. The theory was that these repeated shocks had opened the shaft, which was perhaps badly rolled, along the cinder lines in places, and that these openings had increased in size until finally the break occurred. The paper was briefly discussed by Messrs. Henry Goldmark, W. H. Finley and Samuel G. Artingstall.

Mr. T. T. Johnston's paper was quite long and of such a character as to prohibit any brief abstract, being profusely illustrated with diagrams and maps and containing much statistical matter. It dealt with the water levels on Lakes Superior, Huron and Michigan and the effect of the drainage channel on them and on the Illinois and Mississippi rivers. The effect of the channel would be to lower the level of lakes Michigan and Huron between 5 and 6 ins. This would be felt seriously only at times of extreme low water, and then it was entirely possible to supply extra water from Lake Superior, which could be made to store surplus water by partly closing, or raising, the height of the rock ledge or weir over which the lake empties itself into the St. Mary's River. Respecting the main drainage channel, it was noted that the Chicago River could not supply it with its full capacity of water without creating too swift a cur-

rent and some additional channel of supply would have to be secured from the lake. Several plans had been devised to secure this additional supply, but the one which seemed the most advantageous was to extend the North Branch of the river to the lake. This would effectually flush and cleanse both branches of the river.

Until a full supply of water, to cause a strong current to the west, was furnished the canal, Mr. Johnston stated, there would be some trouble from flood waters flowing back to the lake. This would happen to no such extent as at present, however. The plans of the Des Plaines River diversion work, providing for the flow of all the flood waters of that stream west, were explained. This flood water would raise the Illinois River about 1½ ft. for every 10,000 cu. ft. per second of flow, which would cause no damage. The effect of the drainage channel running full on the Mississippi River would be to raise it 1 ft. at St. Louis, and it was stated that the channel and the reservoirs now being built by the Federal Government at the head of the river combined would enable the river to be raised 6 ft., during low water, at St. Louis. Attention was called to the construction of the Illinois & Mississippi Canal or Hennepin Canal, from the Illinois River near Hennepin to the Mississippi River near Rock Island, and the statement was made that with a less sum than the estimated cost of the canal the Illinois River below Utica, Ill., could be dredged out to give a channel to the Mississippi 14 ft. deep. Such a channel, moreover, would furnish excellent navigation, while with the Hennepin Canal 37 locks will have to be passed. There was no discussion of importance.

AMERICAN INSTITUTE OF MINING ENGINEERS.—The autumn meeting was held Oct. 2 to 6 at Bridgeport, Conn., the headquarters being at the George Hotel, Black Rock, pleasantly located on the shore of the Sound. There were from 80 to 100 members and guests in attendance. At the opening meeting in the evening of Oct. 2, audresses of welcome were made by Mr. Warner and Mr. Porter, of Bridgeport, the latter referring to the industrial progress and importance of that city and of the state of Connecticut. The President, Mr. John Fritz, then read an interesting address on the early history and subsequent development of iron-working in this country, dealing largely with his own personal experience, dating from 1838, when, as an apprentice in a country blacksmith and machine shop, he was sent to make repairs on a charcoal furnace turning out 12 tons of iron per week under favorable conditions. He was later employed at the works founded in 1790 and now owned by the Lukens Iron & Steel Co., and in 1845 went to Norristown, Pa., to assist in the building of a mill for bar iron, of which he afterwards became the manager. In those days the chemistry of iron-making was practically unknown in this country, and the manufacture was somewhat of a haphazard process. In 1854 he assumed charge of a mill at Johnstown, Pa., for rolling iron rails, which had been leased by David Reeves and others, and Mr. Fritz feelingly described the first few rails turned out, having the edges of the flanges looking like saw-teeth and the heads rough and full of small holes. These works (now the plant of the Cambria Iron Co.) had numerous mechanical and financial troubles. When the company desired to put in a new two-high rail train, Mr. Fritz refused to carry out the work on the ground that the improvement effected would not warrant the expense, and he submitted plans for a three-high train. To this the stockholders and the workmen objected, and the former got out legal papers holding the managing partners personally responsible for the building of the new mill, but Mr. E. Y. Townsend, then vice-president, assumed the responsibility, and the mill was built. This was the first three-high rolling mill in the country, and the first rails were rolled July 29, 1857. This was on Thursday and work went on until Saturday, turning out better rails than any previously made in this country, but on Saturday night the new mill was burned down. The success, however, had been such that it was at once rebuilt, and was the best in the country until the invention of Sir Henry Bessemer enabled steel rails to crowd out iron rails.

At the meeting on the morning of Oct. 3 papers were presented on "A Uniform Method for the Assay of Copper Materials for Gold and Silver," by Albert R. Ledoux, and "The Inaccuracy of the Commercial Assay for Silver and of Metallurgical Statistics in Silver Mills, with Special Reference to the Treatment of Roasted Ores by Amalgamation and by the Russell Process," by C. A. Stetefeldt. The purpose of the latter was to show that the reports of managers of silver mills in regard to the percentage of silver saved, are far from being the truth. There was also some discussion on the effect of coal dust in mine explosions, which led to some remarks as to dust explosions in flour, sugar and saw mills. In the afternoon Dr. R. W. Raymond, Secretary of the Institute, read a paper on "The New Mining Law of New York," supplementing a paper presented a few years ago. He showed the injustice to landowners which the new law effects, amounting almost to confiscation of property, the only apparent remedy being for a man to file record of discovery of minerals on his land and thus become entitled to his own property. The next subject was the discussion on the question "Does the Vibration of Stamp Stems Change Their Molecular Structure?" the printed discussion on which was given in our last issue. Mr. Kent said that he was still unsatisfied, but inclined to believe that the stems do crystallize, and that molecular disintegration is going on all the time, even though the change in structure may not be visible. Mr. Rothwell thought possibly the acid water might cause the trouble as in soft steel mine ropes, the ends of which had to be cut off occasionally owing to crystallization. Two or three members recorded the fact that broken stems show a crystalline fracture, and in one case bars which lasted only about six months were made to last over two years by reversing them occasionally. Another member said that in connection with a legal case involving the failure of a screw shaft he took a good car axle, and broke it slowly under a steam hammer, developing a fibrous fracture. He then broke it in another part by one heavy blow, and the result was a crystalline fracture. Dr. Raymond said that it cannot be that the molecules move around and change from a fibrous to a crystalline arrangement, but that they are either pulled out or broken short off according to the way in which the bar is broken. Mr. Kirchoff said that the ends of broken staybolts from an exploded boiler showed a crystalline fracture, but tests of the bolts showed them to be of good, tough metal. In the evening the party went to the city and attended a reception given in honor of the Institute by the Seaside Club at its handsome clubhouse.

On Oct. 4, the party left Bridgeport early by special train, and after stopping at Ansonia, to visit the copper and brass mills of Phelps, Dodge & Co. and the Ansonia Brass & Copper Co., went on to Waterbury, where lunch was served in the armory. The party then visited several of the important works, including those of the Waterbury Watch Co., Holmes, Booth & Hayden, the Waterbury Brass Co. and others. The Farrel Foundry & Machine Co. are makers of numerous varieties of stamping and pressing machines, rolling mill plants, hydraulic presses, etc., and have new machines for cutting small rivets and nuts from the bar, as well as machines for making cold rolled screws. The Scovill Mfg. Co. makes a specialty of stamped work, such as buttons, and decorative work. specimens of which (in the shape of aluminum match boxes and combs) were distributed as souvenirs. Randolph & Clowes are manufacturers of brass and copper tubing. Benedict & Burnham manufacture brass and copper rods and tubes, and are putting in Mannesmann machines for making rolled tubes. The party then returned to Bridgeport.

In the evening there was a business meeting, at which Mr. J. F. Kemp read a paper on "The Nickel Mine at Lancaster Gap, Pa." This is practically the only productive nickel mine in the United States which has been developed, although discoveries have been made in New York, Oregon, etc. The Pennsylvania ore is pyrrhotite like that of Norway and of Sudbury in Canada. The rock is marked through and through with mundic and is very hornblendic in structure. It contains about 1% nickel, some copper and a little gold. The deepest workings are 250 ft. deep. The mine was worked by Mr. Wharton, until February, but it is said to be now full of water. The nickel deposits at Riddles, Ore., resemble those of New Caledonia (Eng. News, May 19, 1892). Some mineralogical curiosities were then exhibited by Mr. John Birkinbine, after which the meeting adjourned.

On Oct. 5 the party was taken around Bridgeport and its suburbs by special cars on the Bridgeport Traction Co.'s lines, under the guidance of Mr. H. N. Heft, President of the company, afterwards visiting several works. The Waterbury Brass Works were first seen, and then the extensive shops of the Wheeler & Wilson Sewing Machine Co., where one of the most interesting departments is that in which the needles are made by a number of separate processes in automatic machines. In these works also is an interesting machine making horseshoe nails from a coil of flat wire fed in at one end. At the works of the Holmes & Edwards Silver Co. were seen the operations of making tableware and beautifully decorated silver articles. The next works were those of the Bridgeport Chain Co., at which automatic machines fed by coils of round wire of various gages were turning out complete chains, from small sizes, suitable for dog chains, sash chains, etc., to larger sizes with heavy links. Souvenirs in the shape of key rings with chains attached were distributed among the visitors.

The next proceeding was a drive through the beautiful Seaside Park and the residence district of the city, ending at the Seaside Institute, where lunch was served. The Institute is a clubhouse with library, dining-rooms, etc., established by Mr. Warner for the use of the girls employed in his corset factory. This factory was afterwards visited, the most interesting work being the manufacture of the stiffening material known as coraline, which is of Mexican cactus fiber woven into cords and several cords then placed side by side and wrapped with fiber. The party then proceeded to the wharf and boarded the steamer "Lenoir" for a trip down the harbor, returning about 5 p. m. In the evening there was a "shore dinner" at the hotel, the courses being all composed of sea food. Nearly 150 persons were present, and there were some interesting speeches made.

On Oct. 6, the party left by special train for New Haven, and proceeded at once to Yale College. After a few words of welcome from the President of the college in Osborn Hall, a visit of inspection was paid to the principal buildings, including the Sheffield Scientific School. That being concluded, carriages were ready to take the party for a drive (by invitation of the Mayor) up to the top of East Rock, a high bluff from which a magnificent view of the city and the surrounding country is obtained. The carriages then conveyed the party back to the station, and the members departed on various trains for their several destinations.

The meeting was a very pleasant one, but it was noticeable (and remarked by many) that there was too little time given to business, and, in fact, these meetings seem to be coming nearer and nearer to the level of mere pleasure excursions, in which case their usefulness and success will certainly diminish, as busy men will not care to give the time for such technically profitless meetings. The visits to works are interesting, but in this case were hurried to such an extent that there was little time or opportunity for really examining any machinery or processes of special novelty or interest. As the Institute now holds but two meetings a year it is to be hoped that in future more consideration will be given to the professional and technical work in the meetings.

COMING TECHNICAL MEETINGS.

MONTANA SOCIETY OF CIVIL ENGINEERS.
Oct. 13. Secy., G. O. Foss, Helena, Mont.
ENGINEERS' CLUB OF INDIANAPOLIS.
Oct. 13. Secy., C. C. Brown.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Oct. 14. Secy., D. W. Meeker, St. Paul, Minn.
ENGINEERS' CLUB OF MINNEAPOLIS.
Oct. 15. Secy., E. Nexsen, Kasota Block.
AMER. SOCIETY OF RAILWAY SUPERINTENDENTS.
Oct. 15. New York. Secy., C. A. Hammond, 32 Liberty St.
ASSOC. SUPERINTENDENTS OF BRIDGES & BUILDING.
Oct. 16. Kansas City, Mo. Secy., S. F. Patterson, Concord, N. H.
WESTERN RAILWAY CLUB.
Oct. 16. Secy., C. F. Street, Rookery Building.
COLUMBIAN ENGINEERING SOCIETY.
Oct. 16. Secy., F. W. Hart, Washington, D. C.
AMERICAN STREET RAILWAY ASSOCIATION.
Oct. 17. Atlanta, Ga. Secy., Wm. J. Richardson, Brooklyn, N. Y.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
Oct. 17. Secy., J. H. Pilcher, Roanoke, Va.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Oct. 17. Secy., S. E. Tinkham, 36 Bromfield St.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Oct. 17. Secy., Francis Collingwood, 127 E. 23d St., N. Y.
ENGINEERS' CLUB OF ST. LOUIS.
Oct. 17. Secy., W. H. Bryan, Turner Block.
ENGINEERS' CLUB OF CINCINNATI.
Oct. 18. Secy., J. F. Wilson, 24 W. 4th St.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Oct. 18. Secy., D. Carhart, Carnegie Library Building, Allegheny.
NEW YORK RAILROAD CLUB.
Oct. 18. Secy., John A. Hill, Temple Court, N. Y. City.
ENGINEERS' CLUB OF PHILADELPHIA.
Oct. 20. Secy., L. F. Rondinella, 1122 Girard St.
DENVER SOCIETY OF CIVIL ENGINEERS.
Oct. 23. Secy., F. Ed. King, 36 Jacobson Block.
CENTRAL RAILWAY CLUB.
Oct. 24. Secy., S. W. Spear, East Buffalo Iron Works, Buffalo, N. Y.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Oct. 25. Secy., C. H. McLeod, 112 Mansfield St., Montreal.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Nov. 2. Secy., O. Von Geldern, 719 Market St., San Francisco.
FRANKLIN INSTITUTE, PHILADELPHIA.
Nov. 2. "A Trip through Germany," by C. J. Hexamer
Secy., W. H. Wahl.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Nov. 5. Secy., C. L. Annam, City Engineer's Office.
WESTERN SOCIETY OF ENGINEERS.
Nov. 7. Secy., Thomas Appleton, Lakeside Bldg., Chicago.
ENGINEERING ASSOCIATION OF THE SOUTH.
Nov. 8. Hunter McDonald, Nashville, Tenn.
ENGINEERS & ARCHITECTS' CLUB OF LOUISVILLE.
Nov. 8. Secy., G. W. Shaw, Norton Building.
WISCONSIN POLYTECHNIC SOCIETY.
Nov. 12. Secy., Geo. G. Mason, 144 4th St., Milwaukee.
ENGINEERS' CLUB OF KANSAS CITY.
Nov. 12. Secy., Waterman Stone, Baird Building.
NORTHWEST RAILWAY CLUB.
Nov. 13. Secy., W. D. Crosman, Ryan Hotel, St. Paul.
NORTHWESTERN SOCIETY OF ENGINEERS.
Nov. 13. Secy., D. W. McMorris, Burke Building, Seattle, Wash.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Nov. 13. Secy., F. C. Osborn, 721 Hickox Building.
NEW ENGLAND RAILROAD CLUB.
Nov. 14. Secy., F. M. Curtis, P. O. Box 1576, Boston, Mass.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Nov. 15. Atlanta, Ga. Secy., F. A. Charpiot, Macon, Ga.
SOCIETY NAVAL ARCHITECTS & MARINE ENGINEERS.
Nov. 15 and 16. Annual Convention in New York city.
Secy., W. L. Capps, U. S. N., Washington, D. C.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 3 to 7. Secy., F. R. Hutton, 12 W. 31st St., New York.

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ADVERTISING RATES: 20 cents per line agate measure. Want notices, special rates, see page 22. Rates for standing advertisements sent on request. Changes of advertisements must be in hand on Monday afternoon: new advertisements, Tuesday afternoon; transient advertisements by Wednesday noon.

What to call death resulting from an electric shock is a question which gave rise to a great deal of discussion some time ago. The best authorities seem to have settled on "electrocution," but the daily press reporters have grown more familiar with another electrical term of late, since the troubles with gas and water-pipes, due to wandering earth currents, came into prominence. This is probably why the "Philadelphia Press" informed its readers last week that "The instant killing of two large draft horses at Newark, N. J., can only be accounted for by electrolysis."

In our issue of Sept. 27, in calling attention to the issuing and placing on sale by the Government of a "Manual of Topographic Methods," as a work which should be in every engineer's library, we stated that the book could be obtained by remitting the price to the Director of the U. S. Geological Survey, Washington, D. C. Notwithstanding this notice, a large number of orders for the book have been sent direct to this office, and to prevent other readers making this mistake, we would explain that the work can only be obtained by purchasers remitting direct to the office of the Survey, as above.

The amendments to the constitution of the American Society of Civil Engineers, which were formally proposed at the annual convention last summer, have been adopted by the letter ballot of the society, as noted elsewhere in this issue. The amendment of most interest is that which requires the Secretary to be elected by the Board of Direction, instead of by general vote of the Society. The amendments take effect before the date of the coming election, so while the Nominating Committee selected a candidate for Secretary, as was its duty under the constitution then existing, the nomination will be nullified by the new amendments, and the office of Secretary will be filled by the new Board of Direction after the annual meeting of the Society in December.

Mr. Wm. Dallin and his Atlantic & Pacific Construction Co., to which we briefly referred in our issue of Aug. 2, appear to be still exciting much interest in the country districts of Ohio. The Bowling Green (Ohio) "Tribune" devotes a column of its valuable space to this subject, and says:

Mr. Dallin has made arrangements with English capitalists to furnish the money as soon as he has the preliminary work done. One part of this work is to raise by subscription $1,000,000 subsidy, most of which has been subscribed. . . . A movement is now on foot to raise Bowling Green's share of the fund, but is being delayed on account of a little change in the form of the note.

One would suppose that this game was too old to be worked at this day, but the fool-killer evidently cannot keep up with his work, and victims seem never lacking for the green-goods swindler, the bunco-steerer and the promoter of bogus enterprises.

The newspaper concludes by printing a letter from Dallin himself, dated at Chicago, Sept. 18. He states that his "double-track air-line railway will shorten the distance from New York to Chicago 200 miles over all other railways," and that "the projectors have contemplated, from the very inception of the enterprise, making it an integral part of the Government." He winds up with the declaration that the whole road, from New York to San Francisco, will be completed in 1900, and will be "the one grand economical event of the close of the nineteenth century."

Words are lacking to do justice to Mr. Dallin and his enterprise. We can only suggest that he ought to seek out "Brick" Pomeroy and get permission to use his "Atlantic & Pacific tunnel" through the Rocky Mountains. The two enterprises appear to be admirably suited to harmonize with each other.

In discussing the effect of shocks on railway bridges in our issue of Aug. 16, we pointed out that the wooden ties form a cushion of considerable elasticity between the rail and the metal work of the structure; and it is reasonable to suppose that they materially diminish the impact strains on the structure from what they would be if the rail rested directly on the metal stringers. In another column of this issue we illustrate a five-track overhead bridge, which is being erected at Chicago, Ill., to carry the tracks of the Lake Shore & Michigan Southern and Chicago, Rock Island & Pacific railways over Archer Ave. The bridge is the first overhead crossing to be undertaken in the extensive work of track elevation on which these companies have entered. The most interesting detail of the structure is the entire elimination of wooden ties or stringers. The track rail is laid on a flat metal plate, ½ in. thick and 18 ins. wide, which is laid directly on the metal flooring. The object in eliminating wooden ties or stringers is doubtless to lower the rail level as much as possible, which is, of course, very important. Whether the absence of the usual wood cushion will cause any injury to the structure by reason of increased impact is a matter concerning which any one can prophesy, but which it will require experience to settle. Much the same thing may be said concerning the amount of noise which this floor construction will generate under a fast train, with the difference, however, that we can be pretty sure beforehand that the amount of noise will not be small.

We do not now recall any existing structure in which rails are laid directly on the metal-work of the structure in a similar manner. The plans for the Park Ave. viaduct for the New York Central & Hudson River R. R., from 110th St. to the Harlem River, New York city (Eng. News, May 25, 1893), showed the rail resting on plates 8 × 12 ins., and ½ in. thick, which rest directly on the troughs. In this case, however, the plan was to fill the hollows of the trough floor with some sound-deadener, to prevent its ringing under the trains. The foundations for this structure are nearly completed, but it will be a considerable time before it is ready for its floor. In countries where steel ties are used, they are sometimes riveted directly to the bridge structure. One such case was shown in our issue of Oct. 6, 1892, and many others doubtless exist.

A design for a floor system in which the rail was laid directly in a heavy steel channel resting on the stringers was made by Gen. E. W. Serrell for the proposed railway suspension bridge, projected some years ago to cross the Hudson River near Peekskill. There may be other examples of a rail resting directly on the metal work of a structure now existing. If any of our readers know of such cases, we trust they will inform us.

The controversy over betterments arising from public improvements in English cities is now attracting widespread interest, in that country, and the evidence presented before Parliament, and elsewhere commented upon in this issue, has developed some curious and unexpected conditions. To an American, one of the most remarkable statements made is that connected with the evident lack of public approval of some of the newer and wider streets of London. One of the experts, in attempting to account for this feature, says that it is due to the fact that Englishmen are very slow to adapt themselves to changed conditions; they prefer accustomed surroundings, even though inconvenient; and once driven from a district by improvements, they will not readily return to it. Be that as it may, the evidence clearly shows that in some of the most important improvements of this kind in London, the new conditions are not popular. Fortunately for us, this condition of conservatism does not exist in the United States, and here, as a rule, improved access to property is desirable and profitable to all concerned. The question of betterment assessment in England has been pretty well discussed, and there is evidently much to say on both sides; but in the opposition to the methods proposed by the London County Council, there is a strong indication of the rising popular feeling in regard to land taxation methods now in vogue. This opposition is against special taxation for an alleged special benefit conferred by an expenditure of public funds, for reasons plainly stated. Instead of this they ask for an all-around equitable tax, and especially demand that undeveloped land should be taxed at its real market value, and not on the present basis of annual value to its owner in its unimproved state. This is a blow aimed at the large landowners of England, who have practically made the laws governing taxation, and naturally have not been inclined to impose too heavy a burden upon their own possessions of this kind. What this movement means can be better understood by looking up the present ownership of English lands. The Domesday Book of 1875, the last one accessible, says that out of a total of 77,635,301 acres of land in England, 1,200 persons hold over one-fourth; 600 peers own over one-fifth of all the land in the United Kingdom, and one-half of the whole territory is in the hands of 7,400 individuals, out of a total population, at that time, of 35,100,000. As these 600 peers practically made the old laws under which much of this land is still taxed, there is little wonder that the other 35,099,400 individuals should at last realize that some radical revision of the land-tax laws might be very desirable and generally beneficial.

PROPERTY ASSESSMENTS FOR STREET IMPROVEMENTS.

The apportionment of cost in street improvements, or so-called "betterments," has been lately attracting widespread attention in England, and many interesting facts have been brought out in the discussion. A special committee of the House of Lords, in considering the subject, has issued a very fair statement of the two sides of the case, applicable here as well as in England, as follows:

The principle of betterments, in other words, the principle that persons whose property has clearly been increased in market value by an improvement effected by local authorities should specially contribute to the cost of the improvement, is not in itself unjust, and such persons can equitably be required to do so. But the effect of a public work in raising the value of neighboring lands is shown by experience to be uncertain. Whether, in any particular case, it is possible for a valuer to pronounce that such an effect has been produced by the completion of any public work is a point upon which the evidence of eminent valuers differ greatly.

The evidence referred to by the committee and quoted in part in the London "Architect," tends decidedly to show that not only in London, but in other large English cities the effect of street widening and improvement upon the value of adjacent property cannot be foretold, even by experts. Among the cases brought forward were the Thames Embankment, Queen Victoria and New Oxford Sts. and Victoria St., Westminster. Each one of these was a vast improvement upon previously ex-

isting conditions of narrow and crooked streets, and much was expected from them in an increase in market and rental value of abutting property. Yet, say the experts, none of these expectations have been realized; though New Oxford St., for example, has now been in existence for nearly 60 years, and seemingly presents the same advantages for trade as the connecting Holborn and Oxford Sts. Houses built upon Victoria St., Westminster, have been empty since the street was formed, and are empty yet. The building of the Holborn Viaduct, one of the greatest of London's improvements, has lessened instead of increased the value of property alongside and on its approaches. The experts declared that the effect of such betterments upon property values was extremely problematical, in view of the heavy losses sustained and bitter disappointments following street improvements in London.

The present controversy arises from the bills introduced by the London County Council and the Manchester Corporation, now before Parliament, and containing betterment clauses. As outlined in the London bill, these provisions are briefly as follows: The area affected will vary with circumstances, but is to be broad enough to include every property which may be especially benefited by the improvement. The Local Government Board first appoints some independent person to make a valuation of the property before improvement, made as if such improvement were not contemplated. After the improvement is carried out, but not later than seven years from the passing of the act, the Council is to make an assessment on each property affected, stating the enhanced value, and the charge to be made is 3 per cent. annually upon one-half this enhanced value. But the owner, if he prefers, may redeem this annual charge by paying in a lump sum the half of the increased value assessed upon. In case of disagreement, the Local Government Board is to appoint an arbitrator, whose decision is to be final and binding; and this arbitrator is to consider also the different interests in the property, and apportion the charge between the freeholder and the owners of any other interests, as he may deem just and having regard to existing contracts. The final charge is to be collected from the occupier of the property, but he may deduct from his rental any part not properly belonging to him.

The proposed bill has brought out a storm of protest, which the County Council answers in its report as best it can. It first says that it is impossible to devise any plan of dealing with this betterment principle which would not be open to some real objections. The Council does not claim that its bill is perfect, but it believes that it is fair and reasonable and can be carried out without difficulty. The bill is founded upon the principle that if the expenditure of public money enhanced a property in value, the owner thereof should be willing to pay half of this increased value; and the tax of 3 per cent. per annum is only a plan to permit this payment in smaller and more convenient sums. To the charge that improving one street often damages an adjoining street by a diversion of traffic, and to the claim that damages should be considered as well as betterments, the Council answers, That compensation for actual damage to property, by changing the level of a street, for example, is now provided for by law; but to pay for depreciation by alteration of traffic is an impracticable proposal. The Council admits that such cases may exist, but it doubts that they exist in any important volume; and in any rate the increase by betterment taxes in his neighborhood lift from the shoulders of the injured owner a portion of the taxing burden.

In answer to the objection that improvement does not always better adjoining property, as on the streets above referred to, the Council says they do not affect the case of the bill in question, which only proposes to charge these properties in a certain area which are "substantially and permanently increased in value." The important objection is made that the betterment charge will be "uncertain and arbitrary." To this the Council answers that such valuations are made every day upon every kind of property, and it does not believe that it is impracticable or even difficult for a competent valuer to fix the price that any property is likely to bring in an open market. While the mental process is called "guessing," it believes that the guesses of a valuer are reasonably and approximately correct, and that ordinary rating assessment is at present fixed by exactly the same method.

It was urged that the municipal authorities had an easy method of securing compensation for the betterment by what is known as "recoupment," or by purchasing more land than the improvement actually requires, and then selling after the improvement is made. This scheme, says the Council, has been tried and has, generally speaking, failed; the reason being that in buying the extra property the city pays not only for the land and property, which can be sold again, but also for compensation for disturbed trades and business, for which there is no return. The principle of betterments, practically laid down in the bill, is not a "new fangled" idea, as some claim; it is as old as the statutes of Charles II.

This is briefly the London County Council's side of the controversy; the other side is presented in a report prepared by the Deputy Town Clerk of Liverpool, and read before the Association of Municipal Corporations, lately in session in London. The text of the opposition is expressed in the following statement:

> Assuming that it is possible to specify the increased value accruing to land as a direct consequence of some particular expenditure out of public funds, there seems no logical or sound reason for selecting the increment arising from that particular expenditure as a subject for special taxation, while the increment arising from all other expenditure is left exempt from special taxation.

The opposition claims next that it is practically impossible to ascertain whether an increase in property value, after a street widening, is due to the widening itself, or to the development in trade and population in the town which in itself creates a demand for land and enhances values. The demand for trade premises and offices in a certain locality may be rapidly increasing, and rentals may be generally rising, as a consequence, in the four or five years preceding a street improvement. Yet, the principle of betterment laid down in the bill requires that such increase in values, between the time of depositing the plans and, say, two years after the completion of the street, be all credited to the expenditure incurred in this public work.

If land is increased in value by reason of the energy and enterprise with which the ratepayers carry on their trade or business, and by reason of the general good government and judicious expenditure of public funds by the municipal corporation, the claim is made that the ratepayer is just as much entitled to a share in the increment arising from these causes as if the increase in value followed some street improvement intended to give greater facilities to traffic.

The experience in provincial towns, and practically also in London, is that a street improvement involving the acquisition and pulling down of business premises or dwelling houses so dislocates the trade on the line of that street that it takes many years for the new property to develop it, or the adjoining property to recover from the temporary depopulation. The slow development of property on a new or widened street has made the "recoupment" plan a financial mistake for nearly every municipality that has tried it in England. It is also pointed out that the annual tax provision of the London County Council bill is a permanent tax based upon a permanent rise in value. In the constant shifting of business and for other reasons this enhanced value may be only maintained for a few years; yet no provision is made for reducing the tax, nor for increasing it if the value continues to rise, and should thus pay a proportionately higher tax.

As to the "recoupment" plan, some amendment of existing law would improve it, says the opposition. For example, the customary sum paid for compulsory sale, over and above the market price, is 10% on this price; this could be limited to 5% on the price. The half share of the increase in value of the land, by reason of the improvement which the owner retains, could also often be set-off against the claim for interrupted business, etc.

The conclusion of the opposition is that the only practical basis for imposing local taxation equitably is to assess all property upon the same basis, and to see that no property escapes assessment at its real value. While some property may benefit more than another from some given item of local expenditure, the increase in taxes on the enhanced value will practically offset this seeming advantage. Under this scheme all undeveloped property should be assessed, not upon its annual value to its owner in its present condition, but upon the real market value of the property as this increases year by year, by reason of the general growth of the town and the expenditures of the municipal authorities in developing the facilities for trade or residence. The claim is made that in England more real and widely extended benefit would accrue from a law properly and fairly taxing the unearned increment in lands than from provisions which only attempt, through a system of betterments, to more equally adjust local taxation; a system which practically applies only to a few corporations.

The two bills referred to—those for London and the Manchester Corporation—are practically identical, except in the rate of annual interest. They have passed the second reading in the House of Commons without division, and have now passed the committee stage.

LETTERS TO THE EDITOR.

PUMPING ENGINES OF LARGE CAPACITY.

Sir: I see that you omit from your list of large pumping engines, in your issue of Sept. 27, the two 30,000,000-gallon engines which are now being erected at the low service pumping station at Chain of Rocks, St. Louis. They are compound engines built by the Edw. P. Allis Co. under a guaranteed duty of 100,000,000 ft.-lbs. per 1,000 lbs. of dry steam on a running test of 720 consecutive hours' duration.

Very truly yours, John A. Laird,
Mechanical Engineer Water-Works Extension.

St. Louis, Mo., Oct. 2, 1894.

THE EFFECT OF PADDLE-WHEEL PROPULSION ON A VESSEL'S TRIM.

Sir: In the paper by Col. E. A. Stevens on the "Design of Ferry Steamers," on page 206 of your issue of Sept. 13, 1894, it is said: "Paddle-wheel engines give a burying moment from the high position of the shaft." Has not the counteracting effect of the opposite rotative moment of the engine been overlooked?

If the center of effort of the paddles and the center of resistance of the hull are at the same level, the moments would exactly balance, and in any case their joint effect is independent of the height of the shaft.

H. W. Brinckerhoff.

New York, Sept. 15, 1894.

(We have referred the above letter to Col. Stevens, who explains that the burying of the bow, which has been found to occur in paddle-wheel ferry-boats by careful measurements, is due to the fact that the center of effort of the paddle-floats and the center of resistance of the hull are not at the same level. The necessity for placing the shaft in its present position limits the submersion of the floats and is the cause of the center of effort being too high.—Ed.)

SUBJECTS FOR THESES.

Sir: As a subject for a thesis investigation I would suggest the determination of the temperature of air after having been passed by mechanical propulsion over heating surfaces of various areas at various velocities and with various initial temperatures. The heating surfaces might be heated by different pressures of steam or different temperatures of hot water. I should think that data obtained by such experiments might lead to the deduction of a general formula, which would give the resulting temperature for any assumed variations of initial temperature, area of heating surface, temperature and velocity.

Respectfully yours, Carl S. Fogh, C. E.

Denver, Colo., Sept. 18, 1894.

GARBAGE CREMATION IN AMERICA.—A CORRECTION.

Sir: Your issue of Aug. 30 contains an article on "Garbage Cremation in America," by Messrs. Baylis and Merkel, which was awarded honorable mention in your thesis competition of 1893.

This article describes among other methods the furnaces of the Engle Sanitary & Cremation Co., which were used to destroy the garbage and sludge cakes at the World's Columbian Exposition. The statement made that "three burners were in operation, consuming 15 gallons each, or a barrel of oil per hour," is an error. The official trial made for eight days (Sept. 28 to Oct. 6, 1893) showed that both furnaces, having six

burners in operation, consumed 42.6 gallons of oil in one hour, an average of 7.1 gallons per hour for each burner. The amount of oil consumed per hour is correct, but the quantity used per burner was double what should have been stated. The paper is most valuable and interesting, as containing calculations of the relative value of heat produced from coal and oil which have not been heretofore published.

Very truly yours, W. F. Morse,
For The Engle Sanitary & Cremation Co.

30 State St., New York, Sept. 29, 1894.

RED LEAD PAINT FOR IRON WORK.

Sir: Would Mr. J. E. Greiner (whose communication appearing in your issue of Aug. 23, 1894, relative to red lead paint, was read with interest by the writer) kindly afford through your columns information as to the drying properties of his mixture of red lead and lampblack. Does he use boiled oil or japan with raw oil? Some painters maintain that red lead and lampblack with raw oil alone will not dry sufficiently soon with as large a quantity of lampblack as an ounce to a pound of red lead, to prevent the red lead running, giving a streaked appearance. Does he find this trouble? Also, would he be willing to give data as to the covering capacity of his mixture as compared with iron oxide and other paints for painting iron; thus presenting a basis for comparing the first cost of red lead with that of other paints. Light on these points would no doubt be appreciated by the engineering fraternity generally, as it would be by

Yours truly, L. D. Jones.

New York, Sept. 26, 1894.

(We have referred this letter to Mr. Greiner, who replies as follows:—Ed.)

Sir: Answering Mr. Jones' questions, I will say that while we specify "no japan" we allow its use in the first coat of paint, but only sufficient to cause the paint to dry in a reasonable time, say, seven or eight hours. In the field no japan whatever is used, as it makes no difference whether the paint takes 8 hours or 24 hours to dry. The red lead does not run sufficiently to give a streaked appearance of the surface painted; on the contrary, so far as my knowledge goes, the bridges painted with this mixture have a uniform covering of a rich, glossy, chocolate color.

The writer has made no investigation as to covering capacity, but would refer Mr. Jones to a valuable little pamphlet published by the National Lead Co., No. 1 Broadway, New York, which gives data showing that a paint of about the proportions described will cover about twice the surface of ordinary oxide paints. When properly applied the paint should wear without renewing for five or six years. Oxide paint lasts from three to four years.

The reason why the writer prefers raw linseed oil is because it is more readily obtained pure. Boiled oil, so called, is often not boiled at all, but merely adulterated with some resin or other substances to give it the proper color. Respectfully, J. E. Greiner,
Engineer of Bridges, B. & O. R. R.

Baltimore, Oct. 5, 1894.

THE SAGINAW BRIDGE FAILURE.

Sir: In your issue of Sept. 27 I notice with peculiar interest an illustrated article on the wrecked swing span at Saginaw, and in justice to myself I take the liberty to correct a statement therein given. While, at the request of the Saginaw Street Railway Co., I had the pleasure to make a proposal some 15 months ago to build a swing span for this crossing on behalf of the Toledo Bridge Co., which I represent, I can hardly claim to have been the designer of the wrecked structure. After receiving my proposal, the street railway company considered it more economical (?) and expedient to make their own design for the turntable and awarded the contract for building the bridge and turntable to a good house-builder and carpenter, no doubt at a reduced price.

Never having seen the structure, I know nothing about the turntable as actually built, nor to what extent any of my original design for the trusses was carried out, nor could I tell to what extent overhead vibration bracing, if any, was placed between the trusses, nor whether the floor beams were rigidly bolted to the bottom chord, nor the quality of metal used for truss rods, etc. It is hardly within the writer's province to point out the moral taught by this otherwise rather fortunate accident.

Yours respectfully, Christopher L. Gates,
Engineer Toledo Bridge Co.

Toledo, O., Oct. 2, 1894.

BLOCK SIGNALS AND CROSSING SIGNALS.

Sir: In the article in your issue of Sept. 20 with reference to block signaling and interlocking recently erected by the Johnson Railroad Signal Co. and the Hall Signal Co. on the Morris & Essex Division of the Delaware, Lackawanna & Western R. R., it is stated that the semaphore interlocking signals in connection with the automatic signals are "merely route signals, quite independent of the block signals." As this statement would cause surprise to people conversant with railway signaling, I beg to say that the semaphores will, of course, be worked in accordance with the block system, the signalman being constantly informed as to the condition of the block sections adjacent to his signal cabin.

Very truly, Arthur H. Johnson,
Western Agent and Consulting Engineer, Johnson Railroad Signal Co.

Chicago, Ill., Sept. 24, 1894.

(The statement quoted was not meant to be taken as our correspondent has understood it, and we do not think many of our readers took it in that way. A proof of the article was submitted to the Hall Signal Co. before publication, and the phrase to which our correspondent objects was not noted by them as incorrect. The statement means that the crossing signals are mechanically independent of the regular block signals. A manually operated plant for crossing signals might be so interlocked with automatic block signals that the setting of the manual signals to show track clear for one would set the automatic signals of the other line at danger. Similarly a train passing the automatic signal might be made to prevent the signalman from showing clear signals for the other line.—Ed.)

WHAT IS A CIVIL ENGINEER?

Sir: Your editorial note in Engineering News of Sept. 13 referring to civil engineers being required to take out a license in Louisville, Ky., brings up the question, What is a civil engineer? In England, the birthplace of modern civil engineering, the term has a very broad meaning, and comprehends the land surveyor, the mechanical and the civil engineer, using these terms as they are here used. Perhaps you will oblige your correspondent by defining the intellectual resources and information which a competent civil engineer should possess?

Candidates for positions in the office of city engineer in Philadelphia are required to pass examinations before the Civil Service Board of that city. This has a tendency to favor the recent graduate, who is primed with text-book information. A practical civil engineer is out of date.

Licenses are required of land surveyors in Canada and Australia, and the requirement is healthful, because it clears out pretentious quacks.

There is a tendency among weak-minded novices, and even among older men, to confuse the public by adding a tail to their names. This tail may be either interpreted Civil Engineer, Christian Endeavor, or any other words that suggest themselves for C. E.

A correspondent in "Building News," Sept. 7, 1894, has this to say concerning the title "C. E.":

> These initials mean nothing except that the man who uses them is mostly a quack or else a fool. He either intends to gull a client into the belief that he is a Member of the Institution of Civil Engineers, or he is idiot enough to think his name looks better with the added initials. The only man I ever knew honest enough to tell the truth was a patent agent, who, when I asked him why he tacked on C. E. after his name, said bluntly because he had found out "there was nothing like cheek in this world." It is not necessary to join the Institution of Civil Engineers, but you will do so if you are wise, because the Institution is a real and creditable representative body of the profession, and not like the Institute of Architects, the representative of a section only. If you don't join, stand on your own merits, and don't ape quack doctors by plastering meaningless or knavishly-intended initials after your name.
>
> This is wholesome medicine to those who have a conscience; to those who have not, it is a forewarning for early failure at their own hands.

Yours truly, "C."

Philadelphia, Pa., Sept. 18, 1894.

(Lack of space between the covers of Engineering News forbids the attempt to set forth in detail the intellectual resources and information which a competent civil engineer should possess. It should be explained that the object of the Louisville city authorities in requiring civil engineers to take out a license is merely to raise revenue for public purposes. Licensing surveyors, to make certain that only competent men are entrusted with the work of tracing property boundaries, is a wholly different matter.—Ed.)

STIFF BRACING FOR VIADUCT TOWERS.

Sir: In your issue of Sept. 20 appears an article entitled "Stiff Bracing for Viaduct Towers," by Mr. Chas. H. Wright, in which he attempts to show the desirability of diagonal rods and pin connections for viaduct towers. I do not believe that a protracted discussion of the relative merits of pin versus riveted connections, which is in reality a part of this subject, would accomplish enough actual good at this day, after all the discussions on this subject which have become matters of record, to entitle it to space in the columns of any reputable engineering journal; for each system has its staunch advocates, and always will have, and it would be as easy to convert one by mere argument from his religious or political views, as to change by argument only the adherent of either style of connection. Experience in the use of both, however, will sometimes accomplish what argument cannot; the writer was at one time a firm advocate of pin connected work to a degree, but two years and more of observation of the action, life and advantages of riveted work, as exemplified on the New York Central & Hudson River R. R. have worked wonders in altering his opinion in favor of riveted connections. I do not expect to convert Mr. Wright, therefore, by the mere pressure of argument, or to accomplish any results beyond attempting to present that "other side" which all questions are said to have.

Rigidity in trestle towers is especially desirable, and it will require a great deal of evidence to the contrary to demonstrate that the tower with angle bracing is not the more rigid. The opening sentence of Mr. Wright's letter is worthy of due consideration. He writes that "At the present time many engineers require the towers of viaducts to have so-called 'stiff bracing.'" I will simply add that even during the writer's recollection there were not so many engineers required it as there are now, and I think it a good indication of the progress of the profession that fewer tall towers with panels of long diagonal rods are built now than in former years. Mr. Wright asserts that single angles, of various sizes mentioned, are used in lengths of from 25 to 40 ft., and asserts that "a round rod has as much compressive strength as such an arrangement." The engineer who will make use of a single angle 40 ft. long in compression, of any of the sizes mentioned, certainly lays himself open to criticism of a severe nature. On the other hand, a round rod 40 ft. long in compression would be a novelty in its way.

From a strictly economical point of view, I must admit that diagonal rods may in certain cases have the advantage, but the tendency at the present time is not so much toward cheap structures as toward lasting, stable and secure ones. Mr. Wright goes through a process of figures to show the cumulative sag and error (the latter assumed) in a riveted tower 140 ft. high.

When the parts are riveted together, the friction of the surfaces riveted in contact will in general be equal to or greater than the strength of the rivets to resist shear, so that the only vibration the tower can have after it is all riveted together is the motion due to the elasticity of the material and the pulling out of such sags as may exist in the diagonals. I do not think the sag of an angle of respectable size can be compared to the sag of the average rod used for such purposes; so, assuming that the rods have been adjusted perfectly, which is unlikely, if not impossible, there remains a large element of "slack" to be taken out by any disturbing force. This gives rise to a degree of motion which cannot be overcome in a structure so constructed.

I have designed riveted towers which have been constructed on portions of the New York Central system and have never heard or seen any such results as set forth by Mr. Wright, and must say that for one I do consider his deduction purely a theoretical one, and from a practical point of view, absurd. The objection set forth in regard to milled joints not "distributing the loads without eccentric strains" is rather far-fetched, as in most pin connected towers that I have seen the milled joint is very much in evidence, as the column splices generally occur beyond the pin, and the load on the column is transferred to the next section of the column by an abutting joint and riveted splices; so that this objection may be cited against either type. The connection shown in Fig. 4, submitted by Mr. Wright, is very commonly used, and I admit that the point as to diagonal bracing intersecting on the center line of columns is often carried to needless extremes.

In conclusion, I will add that art in a viaduct, except in city or village streets, would be wasted indeed, as the average layman will not criticise so closely the appearance of a detail, as he will enjoy and elaborate on the good qualities of a viaduct over which he may speed his trotter without danger of seasickness.

Very respectfully, F. W. Wilson,
Asst. Engr. Bridge Dept., N. Y. C. & H. R. R. R.

New York, Sept. 25, 1894.

TUBULAR-FRAME CARS AND ECONOMY IN FREIGHT EQUIPMENT.

Sir: A short time ago a prominent financier privately expressed the opinion that the time was not ripe for the agitation of the question of new railway equipment, and that not within two years would it be opportune to invest new capital in such channels. The accompanying statement was written to alter his views, and it may also be of interest to your readers. The movement toward the substitution of iron for wood in car construction commenced in 1886, and has been conducted by the Iron Car Co. from that year to 1890. That movement enlisted close on to $10,000,000 in creation of iron cars and in plants for their construction, and 10,000 tube-iron cars are now running.

During 1891 and 1892 there was a halt in the mo-

mentum of this movement, due principally to the rapid development of soft steel as a constructing material; to the recognition of the criticisms of engineers that malleable cast iron (which had been considerably employed in the new cars), being of inferior tensile strength was not the best material for the purpose, and to the further criticism that the tube-iron sills being united only by malleable iron clamps at intervals were somewhat too limber to constitute an ideal beam. The development of the iron car of 1886-90 was along the line of malleable wrought iron and malleable cast iron. There was no steel in it. During that period, however, soft steel came rapidly to the front as a constructive material. Steel axles, truss-rods, channels and tees, steel castings, arch-bars, etc., have become common; while pressed steel has also been crowding its way into every appropriate channel.

The iron car of 1893-94 is practically a steel car, with a corresponding gain in lightness and strength. The sill is of steel, doubled in strength and firmness by the use of a longitudinal wing or web uniting the tubes. One of the tests of merit is the willingness of capital to engage in a given work. Plans have been matured for the building of 15,000 new steel cars in series of 1,500 each, and work is now being prosecuted on the first series. "Revolutions never go backward," and the substitution of steel of high tensile strength for wood in railway equipment is a work that will be fought to a finish. The statement above referred to is as follows:

In answer to the question whether the railway system of the United States is in need of more and better equipment, the following statement is submitted: The freight cars in the United States and Canada number 1,200,000. The greater portion of this equipment consists of old-time wooden cars, kept together by an annual average outlay for repairs of $40 per car, and its use continues for want of something better. The number of freight cars annually rebuilt to replace worn out and collapsed wooden cars and to meet the annual increase in the volume of traffic is 100,000. The bankruptcy and continuous financial troubles of our railways are traceable directly to the miserable character of the greater portion of the equipment in which freight is carried. This equipment is very heavy in proportion to the load carried, antiquated in design, heavy-running and carrying a small percentage of paying load, compared with the gross load of the train, which makes no return for the power expended and the wear and tear on cars and track.

The Pennsylvania R. R. Co. is the rate-maker on this continent. It is the only organization which has modernized its equipment to a considerable extent. Its high-capacity cars are economical, and it pursues its advantage in relentless competition with other roads, naming rates at which it can live, but which drive its weaker competitors to the wall. As an illustration of this policy of the Pennsylvania R. R., it may be stated that the average freight rate on the entire tonnage carried by that company in 1865 was 2.66 cts. per ton per mile. From that year onward the average freight rate steadily and relentlessly declined until, in 1885, 20 years later, it was only 0.627 ct., or less than one-quarter the average rate of 1865.

There have been two principal causes for this decline: First, the substitution of steel rails for iron, in which all railways have shared; second, the substitution of lighter, easier-running, high capacity cars in which to move the freight. In this movement the railways of the United States have not shared equally, and to the extent to which railways have lagged behind in this movement have they encountered formidable financial difficulties. The Philadelphia & Reading R. R. is a notable illustration of this truth. As late as 1885 its equipment consisted of 42,381 freight cars, of which 31,484 were little, four-wheel cars, carrying only five tons of coal; and 10,897 were small, eight-wheel cars, carrying from 10 to 18 tons. Of the entire 42,381 cars there were only 3,141 carrying as much as 18 tons. This miserable equipment, the inheritance of a preceding generation, had cost for repairs from 1881 to 1886 the sum of $4.547,532, an average of $36.49 per car per annum, or half a cent (.004962) for each and every car of coal carried one mile. To ship coal in such vehicles a distance of 1,000 miles would cost for repairs alone the sum of $4.96¼ per car of coal. How frightful a charge against earnings the employment of such equipment really is may be gathered from the statement that this railway's entire bill for repairs on its equipment from 1881 to 1886, inclusive, was over $15,250,000, or an average annual charge of 5% on a capital of $50,000,000.

The hole in earnings made by repairs, however, is not the largest one incident to the use of such rolling stock. A much greater one is that of enlarged operating expenses. The average load of coal carried by the Reading R. R. in the six years ending in 1886 was less than 14 net tons per car (6.948). The modern high-capacity, steel car carries 30 tons and upwards. The significance of this statement may not be apparent at a glance. Let us illustrate by some figures from the Reading's annual reports. During the six years ending in 1886 the total number of tons moved one mile by the Reading R. R. was 23,890,305,279 tons, of which the number of paying or live tons was 9,857,931,503 tons, so that the total weight of cars or dead load was 14,032,373,775 tons, or 58.52% of the total was dead load, and 41.47% live load. That is to say, the freight charges calculated on every 41.47 tons had to pay the cost of moving 100 tons of load and car.

The question now arises what is the actual cost of moving a ton of weight by rail? Turning again to the Reading R. R. reports we find that the total outlay for the six years, 1881-6, for cost of transportation and maintenance of way, was $72,649,250. The total live and dead tonnage moved one mile for the same period was 23,890,305,278 mile-tons. Dividing the former by the latter, we have the actual cost of moving one ton of weight one mile 0.003045, or a little over 0.3 ct. for every ton moved one mile. We have seen above that of every 100 tons moved there was 41.47% paying weight and 58.52% car weight. Multiplying these figures by ratio of cost per mile-ton, which is .003045 ct., we have the following: Actual cost of moving 41.47 tons of paying weight one mile, $0.1263, or 12⅝ cts. Actual cost of moving 58.52 tons of dead load or weight of cars one mile, $0.1782, or 17.8 cts.

Thus it is shown how much greater is the cost of moving about the non-paying tare than of that portion which pays the freight. The final question arises: How is this enormous disproportion between paying freight and the dead car-weight to be remedied? Evidently by carrying the freight in cars that will take heavier loads in proportion to their own weight. The steel tube-frame car, weighing eleven tons, will carry a live weight of 30 tons. Allowing that the car was always returned empty, there would be 57.69% live load and 42.31% dead load. The cost of moving 57.69 tons of paying freight at .003045, would be a little over 17½ cts., and the cost of moving 42.31 tons of dead car-weight a little over 12⅞ cts. By this it is shown that the light, high-capacity cars cause a marked change in the relations between the dead and live loads.

This difference in the cost of conducting the transportation may be shown in a very clear manner as follows: Cost of moving 100 tons paying and dead weight one mile on the Reading R. R. cars, nearly 30½ cts.; freight charges collected on 41.47 tons of paying freight carried one mile in Reading R. R. cars, 56½ cts. Freight charges collected on 57.69 tons paying freight carried one mile in 30-ton tubular cars, 78½ cts. Extra earnings per car per mile, 22 cts. To this must be added the saving in moving the difference of dead load in every 100 tons of weight actually moved. Subtracting from 58.53 tons (the dead weight in Reading R. R. cars) the 42.31 tons (the dead weight in tubular cars) we have 16.22 tons of dead weight not hauled. The cost of hauling this at .003045 per ton-mile is .04936, or nearly five cents for every mile of loaded movement. Adding this to the saving in extra load carried, and we have a total of 27 cts. on every 100 tons of weight moved one mile. It will be seen that if the cost of moving 100 tons of freight and cars be 30.45 cts., the actual cost, when figured only upon the live freight, will be the whole cost (live and dead tons) divided by the paying load. Where the paying load is 41.47%, as in the case of the Reading R. R. cars, 1881-86, the cost per mile ton of paying load is over 7½ mills. This is a high cost-rate, and consequently we shall expect to find a high average freight charge to offset it. A reference to the Reading R. R. reports shows us that the average freight rate for six years, 1881-86, was .013611, or over 13.6 mills per ton per mile.

If, now, we determine the cost of moving 100 tons in 30-ton tubular cars by again dividing the cost of moving 100 tons of paying freight and cars (.3045) by the number of tons of paying load (57.69) in each hundred tons of weight moved, we shall obtain .005278. Subtracting this from the cost per ton-mile in Reading R. R. cars (.007342), we find the difference in cost per ton-mile to be .002064. The total number of tons of coal and merchandise moved on the Reading R. R. in six years, 1881-86, was 8,976,019,162 tons. If this amount of tonnage could have been moved in 30-ton cars, loaded one way, returning empty, the saving per ton-mile would have been .002064 per ton-mile. And for the entire tonnage the saving would have been $18,526,503,550. This is at the rate of over $3,000,000 a year, or 5% per annum on a capital of $60,000,000. This statement takes no account of the excess of repairs on the old five-ton cars over those on the high-capacity steel cars; the average per car for freight and coal cars (1881-86) being $43.56, or a total of $7,916,839. The repairs, however, on the entire Reading equipment during the same period amounted to $15,282,519.

The case of the Reading is that also of other railways to the extent to which they have been distanced in the matter of providing light cars of high capacity for the movement of tonnage. The chief obstacle to dividends and the uninterrupted payment of interest is the necessity which the majority of roads are under of continuing the use of their old-time, low-capacity cars, paying out large sums annually to keep them running at all, and humoring them with light loads that, in many cases, do not bring in enough in charges to balance the expense of operating them. The necessity for new cars is an urgent one through the entire railway system of this country. The distances are long, and there is a definite ratio between the length of the radius along which tonnage may be hauled without eating itself up and the relative live load as compared with the dead load. It was shown that repair of the Reading R. R. coal cars adds $5 a car to cost of coal for every 1,000 miles it is hauled from the mine. The average carload for the entire car movement being less than seven tons, the cost of coal car repairs adds 72 cts. to the cost of coal at the mines for every 1,000 miles the coal is moved.

Another illustration of the necessity for a vast increase in the number of high-capacity cars used in this country may be given as follows: The Reading R. R. average car load, 1881-86, was 13.896 tons. Car service costs ¾ ct., or 7½ mills per car-mile. As coal cars return empty this is 15 mills per mile, or $15 for the trip of 1,000 miles, being $1.08 per ton. Were the coal hauled in 30-ton loads in tubular-frame cars, weighing eleven tons, the car service would be no more than $15 for 30 tons hauled 1,000 miles, the rate being only 50 cts. per ton. This saving of 58 cts. is enough to change a losing shipment into a profitable one. The reorganization of the Reading R. R. in 1886 was a failure, because no account was taken of the principal cause of the company's chronic state of default, the necessity of handling its coal in five-ton cars, thus swallowing up millions of dollars that should have been saved to its security holders, and compelling it to maintain an average freight rate of 1.3611 cts. (1881-86), more than double that which had become habitual on the Pennsylvania R. R. in 1885. As early as 1871 the Pennsylvania R. R. had reduced its average rate to .01389 ct., almost as low as the Reading R. R. maintained 15 years later. Yet, despite these high rates, such was the expense of operating the small cars, the Reading R. R. fell into financial trouble.

Nothing that has been done since 1886 has, to any extent, removed the evil that is gnawing at the vitals of the Reading R. R. True, the writer built 1,545 tube-iron, 30-ton cars for the company, and would have built several thousand more had the management submitted financial terms that were practicable. Some years afterwards the Reading R. R. secured from the Pullman Co. a considerable number of 25-ton wooden coal cars on terms onerous to the railway. This is all that has been done to lessen the heavy transport expense on Reading coal. The company is still compelled largely to submit to the great outgo incident to the use of five-ton cars. If the Reading had 15,000 tubular cars to start anew with, the millions of dollars that would be saved would soon put it on its feet again.

The Pennsylvania R. R. Co. is the most relentless iconoclast of old cars in this country or in the world. It breaks up and burns them whenever the annual repair-bills exceed a very moderate figure. The managers have learned that interest on a new car is much less than the annual cost of repairing an old one, while the difference in load carried by the new, high-capacity cars soon pays back for the principal.

Geo. W. Dithridge,
The Iron Car Co.

New York, June 14, 1894.

(The tubular frame car is familiar to our readers, as it has been more than once described in our columns, and an important improvement patented by Mr. Dithridge is a sill composed of two tubes united by a web, the section resembling an I-beam with tubular flanges. There are so many matters of detail in railway operation and equipment to which the financial troubles of American railways are claimed from time to time to be "directly traceable," that it is very evident the effects of the condition of the freight equipment are decidely overstated by our correspondent, although we of course recognize the fact that the condition of this equipment is an important item in cost of operation. Nor can it reasonably be said that the Pennsylvania R. R. is the only organization which has modernized its equipment to a considerable extent. While a comparison between obsolete 5-ton cars and modern 30-ton cars cannot be considered as satisfactory, it is natural that Mr. Dithridge, from his connection with the Iron Car Co., should rate the tubular-frame car very high; but there is no doubt that he rates the modern type of wooden freight car very much too low. We have several times pointed out the economical advantages resulting from the use of metal in car construction, but in justice to our car builders it should be stated that the modern style of wooden freight car is far superior to the old style considered in the above letter. It is true that the interest on a new car is often less than the cost of repairing an old one, and many roads besides the Pennsylvania are greatly improving their freight equipment and the management of that equipment, but, on the other hand, many roads have not the money to invest in new equipment.—Ed.)

A NEW METHOD OF DETERMINING THE CHARACTER OF STRESS.

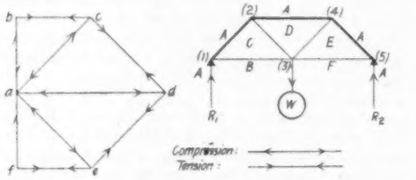
By Benj. F. La Rue.

Those experienced in the analysis of stresses seldom have difficulty in determining whether a given member in a framed structure is under tension or compression. To such, the position of the member, with reference to the external forces acting upon the structure, indicates at once the character of the stress upon it. But the young engineer, or the student, analyzing a structure of unfamiliar design, may sometimes find it difficult to tell whether a member is under compression or tension.

The writer recently noticed a very simple method of indicating the directions of the forces, in drawing stress diagrams, by means of which all doubt as to the nature of each stress is obviated. As the method is believed to be original, it may be of interest to those who use graphical methods and of possible value to those who teach them.

It is well known that, in a complete stress diagram for any framed structure, each line which represents an internal force is common to two force polygons—one polygon for each of the two joints with which is connected the member whose stress the line represents. The line is drawn in one direction in the polygon first constructed, and is conceived to be re-drawn in the opposite direction in the polygon drawn for the joint at the opposite end of the member, corresponding to the direction of the force in each case. If, as the line is drawn in the first polygon and conceived to be retraced in the second polygon, an arrow is each time marked upon it between the center of the line and the end which corresponds to the point of application of the force (indicating in each case the direction of the force with reference to the joint for which the polygon is being drawn), when the stress diagram is completed it will be found that upon each line representing tensile stress the two arrows will point toward each other, while upon each line representing compressive stress the two arrows will point away from each other. These relative positions of the arrows upon stress lines (as shown in Fig. 3) are often used to conventionally indicate tension and compression, and by following this system in marking the arrows the character of each stress may be indicated mechanically with absolute correctness. The method is so very simple that it is remarkable that it has not been previously noticed and used; but, so far as the writer knows, it never has been.

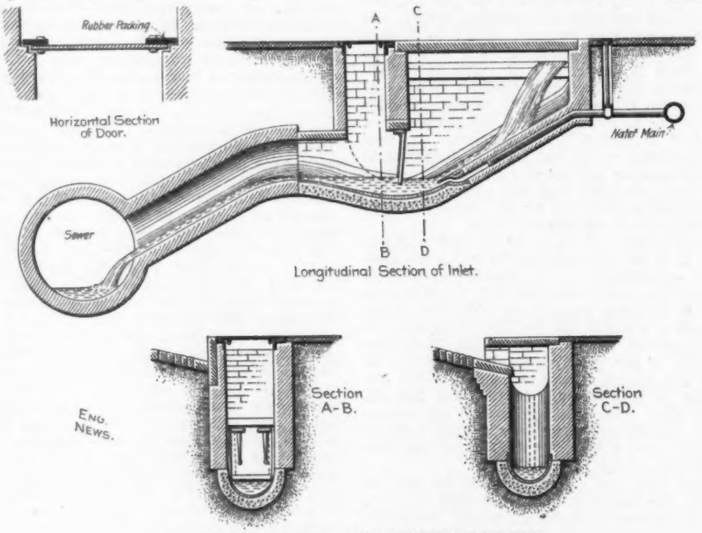
The method will perhaps be more clearly understood if applied in an example. Fig. 1 represents a truss supporting a single load, W, midway between the reactions R_1 and R_2. For this very simple case Fig. 2 is the complete stress diagram. Bow's system of notation is used; that is, in the diagram of the truss the letters are placed in the spaces or at the sides of the lines, while in the stress diagram the letters are placed at the angles or ends of the lines. Corresponding lines lie between the same two letters in each case.



The line a b is drawn to represent the left reaction R_1, and the polygon a b c a is completed for joint (1), an arrow being marked upon each line to indicate the direction of each force with reference to this joint. In this polygon the end b of the line b c corresponds to the point of application of the force represented by the line, or, in other words, to the end of the member B C, which connects at joint (1), at which meet the forces for which the polygon is drawn. Therefore, in this polygon, the arrow indicating the direction of the force in B C with reference to joint (1), is marked upon the line nearer the end b and pointing toward the middle of the line; i. e., following around the polygon. But upon the line c a the arrow for this polygon is marked nearer the end a, also pointing in the direction of the action of the force, or towards a. For joint (2) a c d a is the force polygon. In this polygon the arrow on the line a c is marked nearer to and pointing towards c, because this end of the line corresponds to the end of the member A C at joint (2) and the force in A C must act upon this joint in the opposite direction from which it acts upon joint (1). Thus two arrows pointing away from each other have been marked upon the line a c. On c d the arrow for this polygon is nearer c and points towards the center of the line, while on d a it is nearer a, pointing towards the end of the line. In like manner, as each polygon is drawn, the arrow, representing the direction or sense of the force with reference to the joint for which the polygon is drawn, is marked upon each line nearer the end which corresponds to the end of the member which connects with this joint. When the stress diagram is in this manner completed, by noticing the relative directions of the two arrows marked upon each line of the stress diagram which represents an internal force, it is found that the lines a c, a d and a e represent compression, while the lines b c, c d, d e and e f represent tension.

A TRAPPED STORM SEWER INLET.

The accompanying drawing shows sections of a trapped sewer inlet, which is designed to allow the free passage of water to the sewer, while preventing the accumulation of sediment or other matter in the trap and the escape of sewer gas to the street. The chamber, shown in the accompanying drawing, is placed under the sidewalk at a street intersection. The gate, whose lower edge dips below the water in the trap, is automatically lifted by an increased flow of water, but is normally closed against an inclined seat, as shown. Rubber packing extends beyond the edges of the gate to increase the tightness of the joint.



A TRAPPED INLET FOR STORM SEWERS.

Designed by Chas. P. Kahler, Asst. City Commissioner, Baltimore, Md.

A connection from the street water main is provided, as shown, for the purpose of flushing the basin or renewing the seal. This inlet was invented and patented by Mr. Charles P. Kahler, Assistant City Commissioner, Baltimore, Md., and is manufactured by the Campbell & Zell Co., of Baltimore.

A 6-in. shell with a soft iron cap was recently tried at the Indian Head proving ground in an attempt to discover the secret of the new Russian armor-piercing projectile. Four 6-in. shells were fired at a 6-in. Harveyized plate, with velocities of 1,800, 1,900, 2,000 and 2,100 ft. per second. They were all broken up, and only the last succeeded in perforating the plate. The capped shell did particularly well, but they were all so clearly overmatched by the plate that no definite conclusions were possible.

The recent tests of heavy cast steel shells for high-power rifles of American manufacture, made at Indian Head, are described by Ensign Tisdale, U. S. N., in a report to the Naval Ordnance Bureau. Four shells made by Mr. I. G. Johnson were tested. Three shells were fired from a 10-in. rifle against an 18-in. nickel-steel Harveyized plate, which had been somewhat damaged previously by two Carpenter 12-in. armor-piercing projectiles and one Wheeler-Sterling projectile. This plate was secured to a heavy oak backing by 23 3-in. bolts, and the gun was placed 390 ft. away. The first shot weighed 494 lbs. and the powder charge used was 250 lbs.; the striking velocity was 1,983 ft. per second and the striking energy 13,650 ft.-tons. The shot struck the upper middle of the target and broke up, leaving a hole in the plate of 2 × 3 ft., widening the old cracks and developing a new through crack. The second shot weighed 502 lbs. and with 250 lbs. of powder developed the same energy as before, or 720 ft.-tons per ton of plate. This shot struck the right-hand side of the plate normally; broke up and rebounded, the largest piece being a section of the body and base, weighing 156 lbs. A through crack, 1 in. wide at the shot hole, and another fine crack extending nearly to the top of the plate, were developed. The third shot weighed 501 lbs., was propelled by 250 lbs. of powder, and developed a velocity of 1,980 ft. per second and a striking energy of 13,657 ft.-tons. This shot struck the right edge of the plate; buried itself in the plate and broke off, with an estimated penetration of 15½ ins. The body and base of the shell remained intact for a length of 14 ins. and rebounded, the force of the shot developing a new surface crack, some through cracks and widening all the old cracks. The fourth shot was fired against a 17-in. Harveyized nickel-steel plates, previously attacked by four 12-in. projectiles, with striking velocities ranging from 1,410 to 1,983 ft. per second. The portion of the plate struck was triangular in shape and weighed about 60 tons. The shot weighed 492 lbs., and with 250 lbs. of powder developed a velocity of 1,983 ft. per second and a striking energy of 13,650 ft.-tons. The shell penetrated 20 ins. of the plate and backing, leaving the base sticking out, but considerably broken. The diameter of the shot hole was 10½ ins., showing that the shell swelled but little in penetrating. The whole of the principal part of the plate was badly wrecked. Ensign Tisdale concludes his report with the following comment:

The performance of these shots when their penetration, armor-breaking qualities and conditions after impact are compared with those of the 12-in. armor-piercing shell previously fired against these plates, with striking energy 1½ times greater, cannot fail to bring to notice the superior quality of this particular lot, leaving but little to be desired as far as solid shot is concerned.

The Ohio Steel Co., of Youngstown, Ohio, has practically completed its billet rolling plant at that place, and expects to be in full operation by Jan. 1, 1895. The company was organized some time ago, and included nearly all the Mahoning Valley manufacturers who formerly depended upon Pittsburg mills for their steel billets. Mr. Henry Wick is President; Jos. G. Butler, Vice-President, and W. H. Baldwin is Secretary. The original capital was $1,000,000, since increased to $1,250,000. The mills, if operated as a rail plant, could turn out 1,000 tons per day, and by the use of improved machinery and cheap iron, it is claimed that they could make rails cheaper than those turned out by the Edgar Thomson Works.

The Raddatz submarine boat, described in our issue of Feb. 8, 1894, is said to be "undergoing regular tests" at the hands of its inventor in the river at Oshkosh, Wis. A party of visitors were recently taken for a voyage in the vessel, and spent a half-hour in it, at a depth of thirty feet below the surface.

A concrete dam 33 ft. high, 162 ft. long, 24 ft. thick at the base and 5 ft. at the top is being built in connection with new gravity water-works for Coxsackie, N. Y. Voorhees & Witmer, Buffalo, are the engineers, and T. H. Ryan, North Tonawanda, is the contractor for the work.

A coal steamer for carrying coal between Philadelphia and New England ports is being built at the Cramps' shipbuilding yards, Philadelphia, for the Philadelphia & Reading R. R. This vessel, the "Lebanon," is 249 ft. long on the load line, and 258 ft. 10 ins. long over all. There is a triple-expansion, surface-condensing marine engine of 1,000 HP., with cylinders of 19, 30 and 50 ins. diameter and 30 ins. stroke. The ship will carry 1,600 tons of coal and 190 tons of fuel on a draft of 15 ft. 1¼ ins. forward and 15 ft. 11¼ ins. aft, and will tow three loaded barges carrying 1,500 tons each.

The Firth wheel at the recent exhibition at San Francisco, Cal., was similar to the Ferris wheel, but on a smaller scale. It was 100 ft. diameter and his 16 cars had a total carrying capacity of 160 persons. It was driven by rope-power, by means of a 200-HP. engine.

CONSTRUCTION NEWS.

RAILWAYS.

East of Chicago—Existing Roads.

BANGOR & AROOSTOOK.—Tracklaying on this road in Maine had reached Bridgewater last week and was expected to be completed to Blaine this week, one or two miles being laid each day. The grading is practically completed to Caribou. It is expected that the rails will be laid to Presque Isle and Fort Fairfield this month and to Caribou in November.

OHIO SOUTHERN.—A press report states that the stockholders have authorized the purchase of the uncompleted Columbus, Lima & Milwaukee road and that the line will be built at once to Defiance from Lima, O., and eventually further.

OTTAWA & GATINEAU VALLEY.—A large force is reported at work on the extension of this railway northwest from Ottawa, in Quebec. It is intended to complete the line 1½ miles beyond Gracefield this season.

ST. CROIX & PENOBSCOT.—It is reported probable that this railway will soon be extended from Princeton, Me., 23 to 30 miles to connect with the Maine Central.

WHEELING & LAKE ERIE.—This company is reported about to build a trestle extension along the river front at Martin's Ferry to rolling mills at Aetnaville, O.

WISCASSET & QUEBEC.—Rails and ties have been received for the first 14 miles of this railway in Maine and tracklaying is reported as progressing at the rate of three-quarters of a mile a day.

Projects and Surveys.

MICHIGAN.—Charles Hebard & Son, lumbermen of Pequaming, Mich., are reported about to build a railway from their new redstone quarry at the headwaters of Trap Rock River, north of Lake Linden, to Traverse Bay, a distance of about seven miles. The rails and the locomotives are already ordered and the work will be pushed so as to finish the road this fall if possible.

MONTREAL ISLAND BELT LINE.—Surveys have been completed for this railway, according to Montreal, Que., papers, and $550,000 of the $5,000,000 of capital stock subscribed for. It is probable that the line will be a steam railway, though electricity may be used; Pres., O. M. Auge; Vice-Pres., Wm. Clendinneng; Secy., Arthur Prieur.

RUMFORD FALLS & RANGELEY LAKES.—R. B. Stratton, Ch. Engr., Rumford Falls, Me., writes us that the contract for grading, tracklaying and ballasting the first 18 miles of this railway, recently advertised in Engineering News, has been awarded to Ward Bros., Kennebunk, Me., who will commence work at once and complete as much of the road as possible this fall. We are informed that the headquarters of the contractors will be at Rumford Falls, the terminus of the railway. The railway will be built up Swift River in a northerly direction to the Rangeley Lakes, a distance of 28 miles, and will furnish an outlet for 500,000,000 ft. of spruce timber and large quantities of birch and poplar, besides being a sportsman's short-cut to the hunting and fishing territory about Rangeley Lakes.

STREETS RUN & DRAVOSBURG.—Incorporated in Pennsylvania to build a steam railway from Hays Station to Dravosburg, Allegheny county; capital stock, $40,000; principal office, McKeesport, Pa.; Pres., G. W. Williams, Pittsburg, Pa.

WATERVILLE & QUEBEC.—The promoters of this railway at Waterville, Me., are reported to have raised all but $6,000 of the amount necessary to secure the building of the road, without the assistance asked of the city.

Southern—Existing Roads.

BRISTOL, ELIZABETHTON & NORTH CAROLINA.—It is stated that a meeting was recently held in Bristol, Tenn., between officials of the Chester & Lenoir R. R. and those of this company relative to the construction of a railway to connect the two lines. The Chester & Lenoir extends from Chester, S. C., to Lenoir, N. C., a distance of 100 miles. The Bristol, Elizabethton & North Carolina is projected from Bristol to Asheville, N. C., a distance of 80 miles, and is completed to Elizabethton, Tenn., 22 miles. A line about 62 miles long would have to be built to make the proposed connection.

FLORENCE NORTHERN.—Neely, Smith & Co., Chattanooga, Tenn., the contractors who built this road, purchased the same at auction Oct. 2 for $25,000. The line is projected from Florence, Ala., to Linden, Tenn., a distance of about 80 miles, of which 27 miles were completed ready for the rails in May, 1891.

NORFOLK & WESTERN.—Maj. Samuel Walton is reported to have been awarded the contract for building an 11-mile branch of this railway from Curve, Va., into iron and timber lands recently purchased by a northern syndicate.

MACON, DUBLIN & SAVANNAH.—It is again reported that the construction of this railway to Savannah, Ga., will be resumed at an early date. The line is now in operation from Macon to Dublin, 54 miles. Gen. Man., Jas. T. Wright, Macon, Ga.

SUWANNEE RIVER.—It is reported that E. J. Carter, representing Charles A. Baldwin & Co., New York, has bought this road from Ellaville, Fla., south to Hudson-on-the-Suwannee, 17¾ miles, and that it is the intention to extend it from Ellaville northeast to Jasper on the Georgia Southern & Florida, about 18 miles, and from Hudson-on-the-Suwannee south to Bronson to connect with the Florida Central & Peninsular, about 72 miles.

Projects and Surveys.

NORTHERN NECK.—A press report from Fredericksburg, Va., states that J. A. Higgerson and H. M. Dwyer, capitalists, have spent some time in that section recently investigating the proposed Northern Neck R. R. They have held a meeting with the incorporators of the proposed road and driven over the whole route from the bay to Fredericksburg. The prospects for building the road are regarded as good.

WARREN & CHARLOTTESVILLE.—An exchange states that about $50,000 has been pledged at Charlottesville, Va., for the construction of a railway from that city to Scottsville, Va. W. H. Wood and D. Harmon are among the projectors and the Albemarle Soap Co., Albemarle, is said to be interested.

Northwest—Existing Roads.

BURLINGTON & MISSOURI RIVER.—It is reported that surveys are being made for a short extension from Hot Springs, S. Dak., to the entrance to Wind Cave.

PORT ARTHUR, DULUTH & WESTERN.—Press reports state that the Canadian parliament has finally passed, and the governor-general has approved, the bill granting aid to this railway. The bill gives a bonus of $4,200 per mile for a total of 150 miles, amounting to $630,000. The Ontario government had already passed a bill granting $3,000 per mile for the same distance to the same road, so there is no doubt of its construction. The line will tap the Rainy Lake and Seine River gold district and the Atic-Okan iron country.

ST. LOUIS & EASTERN.—The contract for an extension from Marine to Alhambra, Ill., eight miles, has been awarded to J. A. Ware, St. Louis, who has commenced the construction.

Projects and Surveys.

MERRILL, ANTIGO & EAST.—Incorporated in Wisconsin Oct 3 to build a railway from Prentice, Price county, southeast through Lincoln and Langlade counties to Antigo, a distance of 70 miles; capital stock, $1,000,000; incorporators, L. F. Buckham, L. M. Anson, A. H. Strange, T. S. Heineman and B. Heineman.

PADUCAH, HARRISBURG & CHICAGO.—Incorporated in Illinois to build a railway from Shelbyville to Metropolis, passing through the counties of Shelby, Effingham, Clay, Wayne, Hamilton, Saline, Pope and Massac; capital stock, $3,000,000; directors, Simon S. Berger, Eddyville, Ill.; John W. Mitchell, Metropolis, Ill.; James H. Hildreth, W. H. Ruger, James L. Campbell and Allen T. Young; principal office, Chicago.

SHEBOYGAN, ST. PAUL & CENTRAL.—The council of Sheboygan, Wis., has voted to bond the city to the amount of $35,000 in aid of this railway projected from that city to some point on the St. Paul system near Waldo. The action was taken in compliance with the request of a majority of taxpayers who signed a petition asking for an issue of bonds. Col. W. A. Ray, Chicago, is the president of the company, which has a capital stock of $250,000. It is stated that contracts will be let at once and work on the road pushed so rapidly that trains will be running by Dec. 25 next.

Southwest—Existing Roads.

LITTLE ROCK & MEMPHIS.—The council of Little Rock, Ark., has granted the Little Rock Bridge & Terminal Ry. Co. a perpetual franchise over 1,800 ft. of streets of the city, and the county levying court is reported about to vote a bonus of $200,000 to aid in the construction of the proposed bridge across the Arkansas River, the bridge to be free for wagons and passenger travel and be completed Jan. 1, 1896. The franchise will be owned and operated by the Little Rock & Memphis R. R. Co.——The Little Rock Bridge & Terminal R. R. Co. filed articles of incorporation last week; capital stock, $600,000; directors, A. L. Breysacher, Jr., J. M. Rose, F. W. Gibb, Allen Johnson, D. A. Gray and W. H. Ragland.

ST. LOUIS, KANSAS CITY & COLORADO.—A correspondent writes us that Col. Waite, Ch. Engr., has completed a trip from Union, Mo., the present terminus, west to Versailles, 126 miles. The line will be extended from Union to Owensville and Koe'tztown first, 60 miles, but little will be done until the road is taken out of the receiver's hands.

VELASCO TERMINAL.—It is reported that this railway, extending from Chenango Junction to Velasco, Tex., 20 miles, has been purchased by the Brice-Thomas syndicate, which includes Senator Farwell and other well-known capitalists, and that contracts will soon be awarded for 3,000 to 5,000 cars of stone for the jetties and the railway extended to a connection with the Santa Fe near Marvel and the Houston branch near Alvin, at an expense of about $1,000,000.

Rocky Mt. & Pacific—Existing Roads.

MOHAWK VALLEY.—The Reno, Nev., "Journal" states as follows: This railway is to be extended into Plumas county, Cal., and connection made with the Nevada-California-Oregon at once. The road is graded from 1½ miles south of Chat, Cal., on the N.-C.-O. to Mohawk Valley, a distance of over 30 miles. The rails are laid through Beckwith Pass and Sierra Valley, a distance of about 15 miles. There are no locomotives or cars and the ties are rotting and rails rusting from disuse. A large sawmill belonging to the railway company is built on the line of the road, but it never was used except to saw ties, and a million or more feet of logs are piled upon the hill above the mill. The road will connect with the N.-C.-O. a mile or two south of Chat, and will be extended into the timber on the Middle Fork of the Feather River where there is one of the finest belts of sugar pine in the Sierra Nevada Mountains. It runs through Sierra Valley, which is one of the most extensive farming and hay-producing valleys in the mountains.

NORTHERN PACIFIC.—It is reported that this company contemplates building a spur-track from the Gray's Harbor line to Aberdeen, Wash., a distance of about three miles, providing the citizens of Aberdeen assist in the construction. The grading at one time was practically completed at a reported expense of nearly $80,000.

Projects and Surveys.

BLAINE & EASTERN.—The Seattle "Post-Intelligencer" states that M. J. Heney, the contractor for this railway, which is to be built from Blaine to Nooksack, Wash., where it will connect with the Lake Shore road, has just returned from the East and has made arrangements with New York and Chicago capitalists for the construction of the road within the time specified in the subsidy agreement. Mr. Spencer and his associates, who took up the project some months ago, have assigned their interests to the new syndicate and the company is undergoing the process of reorganization. When this is completed the work of construction will be begun.

GRASS CREEK TERMINAL CO.—Organized in Utah to build a railway from Grass Creek Junction, on the Echo & Park City Ry., up Grass Creek canyon six miles to coal mines at an estimated cost of $120,000; surveys now being made; Pres., Geo. Q. Cannon; Vice-Pres., Jos. F. Smith; Secy. and Treas., Arthur Winter; other directors, Wilford Woodruff, Wm. W. Cluff and James Jack.

STREET AND ELECTRIC RAILWAYS.

FAIRFIELD, ME.—The Waterville & Fairfield Ry. Co. has been petitioned by Lawrence, Newhall & Co., Shawmut, to extend its electric line from this city to that place, a distance of 2½ miles.

BEVERLY, MASS.—The Gloucester, Essex & Beverly St. Ry. Co., recently incorporated, will construct an electric railway 18 miles in length. Bonds for $250,000 and $250,000 in stock will be issued. Pres., W. B. Ferguson, Boston; directors, A. B. Bruce, Lawrence; N. E. Norton, Supt., L., L. & H. St. Ry. Co.; J. H. Cunningham, Boston.

HOLYOKE, MASS.—The Holyoke St. Ry. Co. is reported to have made arrangements to construct a line to Chicopee.

DANBURY, CONN.—The Eastern Tramway Construction Co. has been incorporated under the laws of New Jersey, to operate in this city; capital stock, $2,000; incorporators, Howard Ellis, Ridgewood, N. J.; J. E. Bowles and G. H. Wright, New York.

BALLSTON SPA, N. Y.—The town board of Milton has granted a franchise to the Ballston Spa Electric Light & Power Co. for an electric railway from this city to Rock City Falls. The application of the company to the trustees of the village of Ballston has not yet been acted upon. Secretary Westcot, of the company, is reported as stating that work will be begun as soon as possible after the franchises are granted. The main purpose of the road will be the transportation of freight.

KINGSTON, N. Y.—It is reported that efforts are being made to construct an electric railway from this place to Esopus.

PEEKSKILL, N. Y.—The Peekskill, State Camp & Mohegan Ry. Co. has been incorporated to construct a street railway about four miles in length, and also branch lines about five miles in length, in Peekskill and in Cortland and Yorktown; capital stock, $175,000; directors, F. C. Beach, E. B. Gallagher, C. E. Hammond, G. M. Bailey and G. F. Kunz New York; H. L. Armstrong, T. D. Husted and J. B. Westbrook, Peekskill; and G. D. Hiscox, Brooklyn.

PLATTSBURG, N. Y.—There is talk of constructing a street railway to the Hotel Champlain, with branch lines. Benjamin Norton is interested.

SARATOGA SPRINGS, N. Y.—The granting of a franchise to a company to construct an electric railway from this place to Rock City Falls is being discussed by the council. C. H. Barnes, Boston, is interested.

ELLISBURG, N. J.—The citizens have petitioned the West Jersey Traction Co. to extend its electric line from Haddonfield to this place.

SPRINGFIELD, N. J.—The North New Jersey Traction Co., which is controlled by the Consolidated Traction Co., has been granted a franchise to construct an electric railway from Orange to this place

TRENTON, N. J.—The New York & Philadelphia Electric Ry. Co., which is controlled by the Consolidated Traction Co., is securing right of way from this city to Camden by way of Bordentown, Burlington and Palmyra.

DOYLESTOWN, PA.—The Keystone Electric St. Ry. Co. has been incorporated with a capital stock of $180,000, to construct a line to Philadelphia, a distance of 30 miles. Pres., T. W. Smith, Tacony, Philadelphia; directors, P. C. Costello, David Martin.

MEADVILLE, PA.—J. J. Griffin, Buffalo, N. Y., representing the General Electric Co., of New York, is investigating the advisability of constructing an electric railway from this city to connect with various towns in this vicinity.

ROYERSFORD, PA.—Surveys will soon be commenced for the construction of the Citizens' Passenger Ry. extension from Norristown to this place.

BALTIMORE, MD.—The Clifton Park Passenger Ry. Co. has been incorporated with a capital stock of $50,000; Pres., W. J. Taylor; incorporators, A. J. Ulman, F. N. Hoen, Davies Murdock and E. B. Hunting.

HAMPSTEAD, MD.—G. R. Webb and John Jamison, Baltimore, are interested in a proposed electric railway from Reisterstown to this place, over the Baltimore and Hanover turnpike.

WASHINGTON, D. C.—The Falls Church & Potomac Electric Ry. Co. is considering extending its line from Arlington to Georgetown. Pres., Maj. O. E. Hine, Vienna; Vice-Pres., Gen. S. S. Burdette, Carlins Springs; Secy., Maj. R. S. Lacy, Ballston; Treas., N.F. Graham, West End.

RICHMOND, VA.—A franchise has been granted to the Manchester Ry. & Improvement Co. to equip its line with electricity and to extend it to Chimborazo Park.

CLEVELAND, O.—The Cuyahoga Suburban Ry. Co. has secured right of way for an electric railway to Randall, a distance of 4½ miles, estimated to cost $50,000. It is proposed to construct a power house midway between the two cities, estimated to cost about $6,500. The company is now securing right of way for a branch road to Chagrin Falls and Bedford from Randall. C. C. Thompson and Capt. John Mitchell are interested.

IRONTON, O.—It is reported that a company is to be formed to purchase the Ironton & Petersburg St. Ry. and convert it into an electric line. H. A. Merting, Pres., Eagle Iron & Steel Wks., Canton, and D. Lauar, New York, are interested.

MANCHESTER, O.—The Manchester & Northern Ry. was referred to in our issue of Sept. 20 as an electric line, but we are informed by Heald & Holliday, Ironton, that gas engines will be used for motors. The railway will extend from Manchester to Winchester, O., a distance of 25 miles, and is to be completed before Jan. 1. Ch. Engr., Chas. R. Diemar; contractor, L. J. Highland, 1436 Monadnock Block, Chicago; C. W. Lyman in charge for contractor.

SILVERTON, O.—The question of constructing an electric railway to connect Pleasant Ridge, Kennedy Heights and this place is being discussed.

ANDERSON, IND.—The Indianapolis, Anderson, Alexandria & Marion Electric Ry. Co. has been granted a franchise to construct its line through Grant county.

GOSHEN, IND.—The Indiana Electric Ry. Co. is building 70 miles of railway, of which, 6½ miles in Elkhart, is being reconstructed (it having been operated by another company) and the balance is in Goshen and on inter-urban lines. Some 30 miles have been located and construction is now going forward. The operation of the Elkhart city line and the Goshen-Elkhart inter-urban will begin in about 90 days. Pres., J. J. Burns; Secy., W. L. Stonex; Ch. Engr. and Gen. Supt., J. Clyde Power; principal office, Goshen, Ind. The road will haul passengers, small freight, mail and express.

CHICAGO, ILL.—The Lake Shore Electric R. R. Co. has been incorporated to construct a line to Milwaukee; capital stock, $10,000,000; incorporators, J. J. Cochran, Clarence Buckingham, Dunlap Smith and D. H. Louderbach.——The West Chicago St. R. R. Co., the North Chicago St. R. R. Co. and the Chicago City Ry. Co. have applied for franchises to construct and equip their lines with electricity.

EAST ST. LOUIS, ILL.—It is reported that arrangements are being made to extend the Broadway branch of the street railway to Winstanley Park and Collinsville Ave.

COUNCIL BLUFFS, IA.—The Twin City St. Ry. Co. has petitioned the council for a franchise.

HANNIBAL, MO.—Surveys are being made for an electric railway between this city and Philadelphia, a distance of 38 miles, estimated to cost $20,000 a mile, according to reports.

ST. LOUIS, MO.—The Green Line & Arsenal Ry. Co. has received bids for constructing an electric railway estimated to cost $200,000, with 30 double-end cars, according to reports.

WAUKESHA, WIS.—The contract for grading the Waukesha Beach Electric Ry. has been awarded to P. S. Loy, Depere, Wis., the work to be completed by Dec. 1. Engr., Wm. Powrie.

SPOKANE, WASH.—The Lidgewood Electric Co. is reported as making arrangements to construct a railway to Hillyard, a distance of one mile.

LOS ANGELES, CAL.—The Consolidated Electric Ry. Co. has petitioned for a franchise to change its motive power to electricity.

PHOENIX, ARIZ.—Arrangements are being made for an electric railway from the Montgomery addition to the center of this city. Messrs. Kittridge, Hedges & Dobbins are interested.

BUCKINGHAM, ONT.—Albert MacLaren has been granted a franchise for an electric railway and for supplying the town with electricity for light and heat.

ST. THOMAS, ONT.—Press reports state that the St. Thomas St. Ry. has been sold to the syndicate which controls the Toronto, London, Cleveland, Montreal, St. John and Winnepeg systems. The line will be extended and converted into an electric line.

ELEVATED RAILWAYS.

CHICAGO, ILL.—The Cook Elevated Electric Ry. Co. has been incorporated to build a railway to Milwaukee; capital stock, $10,000,000; incorporators, Mark Sands, J. E. Gaule and C. H. Leopold, 90 La Salle St.

HIGHWAYS.

OHIO.—It is reported that bids are asked by the surveyor of Franklin county, Columbus, for macadamizing a road from that city to Dublin.

MISSOURI.—Bids are asked until Oct. 26 for 2½ miles of grading and 1½ miles of macadam, and until Oct. 27 and 29 for grading five roads and macadamizing two roads in Jackson county. F. J. O'Flaherty, County Surv., Kansas City.

BRIDGES.

ALBANY, N. Y.—Bids are asked until Oct. 23 for six contracts for bridge work. Edward Hannan, Supt. Pub. Wks.

SCRANTON, PA.—Bids will soon be asked by the city for a new bridge, according to reports.

INTERMONT, VA.—The Norfolk & Western officials are reported as considering a proposition for building a $15,000 bridge across the New River, at Lurich, and take payment in the bonds of Monroe county, W. Va.

TAMPA, FLA.—It is stated that the recent storm caused considerable damage to bridges in this city and vicinity.

NATCHITOCHES, LA.—A contract for an iron bridge over Bayou Natchez has been awarded to the Youngstown Bridge Co., at about $2,300.

CINCINNATI, O.—Bids are asked by the county commissioners until Oct. 27 for the construction of a culvert and fill in Springfield township.

CLEVELAND, O.—The following bids were received for the construction of the superstructure of the iron bridge at South Rocky River:

McAllister & Dail	$94,100
Variety Iron Works	125,300
Toledo Bridge Co.	126,900
Canton Bridge Co.	130,000
King Bridge Co.	124,877
Massillon Bridge Co.	127,500
Youngstown Bridge Co.	128,700

The county commissioners were offered $162,311 for the $150,000 of bridge bonds authorized by the legislature.

DAYTON, O.—Bids are asked until Oct. 25 for an iron hoist bridge across the canal at Warren St., clear span of 57 ft. 9 ins.; roadway of 38 ft. and two 8-ft. walks. C. A. Herbig, Cy. Comptroller.

TOLEDO, O.—An election will be held Nov. 6 to vote on an issue of $200,000 in bonds for a bridge across the Maumee River in this city. Guy G. Major, Mayor.

INDIANAPOLIS, IND.—The county commissioners have awarded the contract for the First St. bridge to the Wrought Iron Bridge Co., at $32,000 for both masonry and superstructure, and that for the Pleasant Run bridge to the Toledo Bridge Co., at $7,425.

LANSING, MICH.—The following bids were received for the substructure and paving and sidewalks of the Michigan Ave. bridge:

	Substructure.	Paving.
Chittenden & O'Connor	$24,939	$8,243
S. S. Ramsey	24,696	.....
M. E. Fitzpatrick	19,845	6,601
Newlands & Frazer	18,301	9,576

BLOUNT, ILL.—The town has voted to build two bridges. The first election for this work was declared illegal.

LINCOLN, NEB.—An election will soon be held to vote on a proposition to issue $150,000 in bonds for the construction of a viaduct 1,875 ft. in length in Ninth St.

LITTLE ROCK, ARK.—It is stated that a bridge will soon be built across the Arkansas River at this place, as noted under Railways.

DENVER, COLO.—Bids will soon be asked, according to reports, for a $25,000 bridge to replace the bridge which broke down some time ago at 38th St.

WATER-WORKS.

CALAIS, ME.—Mr. Getchell, of Augusta, is reported to have been engaged to prepare plans for works.

BOOTHBAY HARBOR, ME.—The town has appropriated $10,000 to complete the works. A. R. Nickerson, K. H. Richards and J. H. Blair, Comrs.

PORTSMOUTH, N. H.—The city has sold $10,000 in water bonds for $10,400.

ADAMS, MASS.—Plans are being considered for a supply from driven wells.

BOSTON, MASS.—The following bids were received Oct. 3 for building an addition to the Mystic pumping station and engine and boiler foundations in the same, at West Medford: Fallon & Cronin, $9,600; T. S. Brown, $11,185; Mack & Moore, $10,278; John Moyle, $17,389; D. J. McKim, $10,100; H. P. Cummings & Co., $11,900; G. G. Baker, $14,184.

GREENFIELD, MASS.—The committee on an increased supply is reported as in favor of raising the Glen reservoir dam 14 ft., at a cost of about $15,000, though the question of a pumping station to cost $6,000 is thought preferable by many.

HATFIELD, MASS.—The citizens voted, 43 to 41, against works estimated to cost $30,000.

HOPKINTON, MASS.—It is reported that a town meeting may soon be held to secure a supply for Woodville.

LONGMEADOW, MASS.—The citizens have rescinded the vote to contract with the Thompsonville (Conn.) Water Co. for a supply, as recently noted, and have voted to issue $30,000 in bonds for municipal works.

MEDFORD, MASS.—The bids for a steel stand-pipe were published last week under Contract Prices. The contract for constructing the foundation and for a dam, etc., at Whight's Pond has been awarded to Ross & Cole, Waltham, at $6,387, the other bidders being the National Construction Co., Boston, $7,038; A. W. Byrne, West Medford, $8,221; Weaving, Booth & Co., Medford, $8,242; McCosker Bros., Waltham, $8,936; D. F. O'Connell, Boston, $8,711; M. Cashman, Malden, $8,983; G. H. Wetherbee, Jr., Brockton, $9,457; Leavitt, Dailey & Crockett, Boston, $9,630; J. N. Drew & Co., Newton, $9,769; F. Stewart & Son, Boston, $11,411.

NEWTON, MASS.—The council has passed ordinances for extensions to cost about $7,000.

EDGARTOWN, MASS.—J. K. Nye, New Bedford, was in this town last week investigating the question of a supply.

STOUGHTON, MASS.—The citizens have voted to make extensions estimated to cost $5,000.

CANANDAIGUA, N. Y.—Walter F. Randall, East Syracuse, is reported as preparing plans for works.

CORNING, N. Y.—About $5,000 has been appropriated by the council for extensions.

EAST BRANCH, N. Y.—It is reported that the citizens have voted to put in works.

ELLICOTTVILLE, N. Y.—The Ellicottville Water Co. is reported to have contracted with Mr. Wilson, of Buffalo, for extensions and improvements to cost $20,000.

FORT PLAIN, N. Y.—The commissioners are negotiating with the water company for better service. Preliminary surveys have been made for new works. Wm. Clark, Comr.

JOHNSTOWN, N. Y.—At the election Oct. 2 the citizens voted in favor of the appropriation of $75,000 for improvements and extensions, as noted last week.

MOUNT VERNON, N. Y.—Chas. B. Ludwig has been appointed receiver for the New York City Suburban Water Co. of this place.

SYRACUSE, N. Y.—W. R. Hill, Ch. Engr., is preparing specifications for the removal of about 24,000 cu. yds. of earth from the bed of the channel of the outlet of Skaneateles Lake, for which it is reported that bids will soon be asked.

TULLY, N. Y.—A well 15 ft. in diameter is being sunk to secure a supply.

SEA ISLE CITY, N. J.—Efforts are being made to secure works.

ALLEGHENY, PA.—The committee has been authorized to advertise for bids for three 12,000,000-gallon pumping engines.

DUNCANNON, PA.—The Trout Run Water Co. has commenced the construction of its works, which will probably be completed in about 60 days. S. B. Sheller, Ch. Burgess.

EAST GREENVILLE, PA.—It is reported that the question will be voted upon next month. Levi Meschter and Milton Krause are interested.

HAZLETON, PA.—The committee has adopted the plans noted last week and directed H. Brooks Cellax, Cy. Engr., to make supplementary surveys; estimated cost, $216,801.——The Diamond Water Co. has contracted with the National Boring & Drilling Co., Scranton, to sink an artesian well near its storage reservoir.

HOPBOTTOM, PA.—It is reported that works will be put in.

LEBANON, PA.—It is reported probable that an additional supply will soon be procured at Finnegan's Dam on the Big Swatara Creek, three miles above Johnstown, at an estimated cost of $50,000, including a pumping plant. The council seems opposed to the more expensive plans proposed.

LE RAYSVILLE, PA.—The question of works is reported as being agitated.

MACUNGIE, PA.—Press reports state that the question will be voted upon next month.

McKEESPORT, PA.—The council is considering the adoption of the meter system. There are 3,000 consumers and 400 meters now in use.

PHILADELPHIA, PA.—The director of public works has reported to the council that with additional pumping facilities and a filtration plant at the Lardner's Point station the northeastern section of the city could be given a separate and ample supply from the Delaware River, at an estimated cost of $1,167,000.

SHENANDOAH, PA.—An election will be held Nov. 6 to vote on an issue of $50,000 in bonds to complete the works, upon which $95,000 has already been spent.

WARREN, PA.—The question of new works to be owned by the town is being agitated.

WILKES BARRE, PA.—The Campbells Ledge Water Supply Co., to supply Wyoming and Lackawanna valleys, and the Consumers' Water Co., to supply this city, were incorporated last week; capital stock of each, $4,000; Treas., Geo. H. Butler, Dorranceton, Pa.

SEAFORD, DEL.—The citizens have voted to put in works.

MOUNTAIN LAKE PARK, MD.—The Mountain Lake Park Association will probably put in works; supply from springs.

BEDFORD CITY, VA.—The citizens have voted to appropriate $10,000 for increasing the supply.

NORFOLK, VA.—The local press is urging that steps be taken at once toward securing an increased and improved supply.

ROANOKE, VA.—Press reports from this city state that the Norfolk & Western R. R. Co. will extend its water main from Graham, Va., to Bluefield, W. Va.

CHARLESTON, W. VA.—The Catlettsburg, Kenova & Cereda Water Co. was incorporated Oct. 6; capital stock, $500,000; incorporators, L. Prichard, W. S. Edwards, H. L. Prichard, F. C. Prichard and J. D. Foster, all of this city.

ELIZABETH CITY, N. C.—A committee is investigating the question of works for fire protection. C. C. Allen is city clerk.

COLUMBUS, GA.—An election will be held Dec. 8 at which the question of issuing $350,000 in bonds for works will be voted upon.

OXFORD, MISS.—The council has ordered an election to vote on the question of works.

CALHOUN, KY.—The question of works continues to be agitated, according to reports.

MIDDLESBORO, KY.—The works were sold Oct. 1 to J. R. Sampson for $50,000. It is stated that the cost three years ago was $500,000.

ARLINGTON HEIGHTS, O.—Bids are asked until Nov. 7 for the purchase of $6,000 in bonds for laying mains, etc. J. T. Hall, Clk.

CADIZ, O.—The citizens have again voted to construct works estimated to cost about $36,000; no plans yet prepared, according to reports. W. H. Lucas, Cy. Clk.

COLUMBIANA, O.—E. J. Millar, Steubenville, O., has been engaged by the town to make plans for works; supply from wells and distributed from a stand-pipe; estimated cost, $25,000 to $30,000.

HOME CITY, O.—The question of works is reported as again being discussed.

MILLERSBURG, O.—Petitions are being circulated for works to be owned by the town, according to reports.

VERMILLION, O.—The citizens are reported as about to have works.

WAPAKONETA, O.—The council has passed an ordinance providing for an election to vote on the question of issuing $60,000 in bonds for works.

WOOSTER, O.—Minor Scovel has been engaged as consulting engineer for a city water supply. Dr. Jas. D. Beer and W. J. Mullins are members of the commission.

CAMBRIDGE CITY, IND.—Bids are asked until Oct. 25 for constructing works, as stated in our advertising columns. Engrs., Voorhees & Witmer, Buffalo. C. H. Tabke, Town Clk.

CONNERSVILLE, IND.—It is reported that works may be put in at East Connersville.

GRAYSVILLE, IND.—There is talk of constructing works, according to reports.

LADOGA, IND.—Harry B. Bell, Clk., writes us that the Ladoga Electric Light & Power Co. proposes to put in works; supply from wells; population, 2,500. S. F. Kyle is president of the company.

HARBOR SPRINGS, MICH.—It is tated that the city will purchase the works for $18,000.

LAKEVIEW, MICH.—There is talk of works, according to reports.

TEKONSHA, MICH.—A petition has been signed asking for better fire protection.

ANGELO, ILL.—Reports state that works may be put in.

DUNDEE, ILL.—D. H. Mead, Rockford, is preparing plans for works, for the construction of which the bonds have already been sold. C. F. Howard is village clerk.

FARMER CITY, ILL.—The materials for works have been purchased, according to reports.

HOMER, ILL.—The citizens recently voted against the construction of works, and it is reported probable that another election will soon be held to vote on the question.

OSWEGO, ILL.—Steps are being taken to issue bonds for works; supply will probably be pumped from springs, by a gasoline pumping engine, to an elevated tank.

COLUMBUS, WIS.—Fairbanks, Morse & Co. are preparing plans and specifications for works. No election has yet been held.

LA CROSSE, WIS.—The water committee of the board of trade has reported in favor of a supply from the Mississippi River.

WAUPUN, WIS.—The election recently noted, at which the citizens voted to issue $40,000 in bonds for works, has been declared illegal and another election will be held Nov. 13.

EAGLE GROVE, IA.—Bids are asked until Oct. 20 for constructing works, as stated in our proposal columns. Eugene Schaffter, Cy. Clk.

FOREST CITY, IA.—It is stated that bonds have been voted for works.

OTTUMWA, IA.—Efforts are being made to secure a better supply.

PELLA, IA.—The question of works is reported as continuing to be agitated. John Faassen is city clerk.

POSTVILLE, IA.—The citizens have voted to issue $8,000 in bonds for works.

ROCKWELL CITY, IA.—It is reported that an election will soon be held to vote on the question of works.

ROLFE, IA.—Plans and specifications for works are being prepared by the Howe Pump & Engine Co.; supply will probably be pumped from a well to a reservoir. The city is to pay $50 for the plans unless the Howe company secures the contract for the construction, in which case the plans cost the city nothing.

SABULA, IA.—It is reported that works will probably be put in.

WINTHERSET, IA.—There is talk of issuing bonds for works, according to reports.

ELYSIAN, MINN.—Bids will probably be asked within a few days for the construction of works and the purchase of $3,500 in 5% bonds. C. F. Johnson is president of the council.

NEW PAYNESVILLE, MINN.—Bids were asked until Oct. 8 for the purchase of 6% 20-year bonds for works. A. T. Watson, Recdr.

ST. CLOUD, MINN.—Plans are being considered, according to reports, for an extension of the mains to the reformatory, a distance of two miles, at an estimated cost of $10,000.

ZUMBROTA, MINN.—Bids were asked until Oct. 11 for the construction of works and the purchase of $3,000 in 5% water bonds. W. W. Kinne, Village Recdr.

FIRTH, NEB.—Bonds have been voted for works, according to reports.

LYONS, NEB.—It is reported that $11,000 in bonds will be sold for works.

MANDAN, N. DAK.—Important extensions are reported as contemplated. Address H. H. Harman, Cy. Surv.

DE SOTO, MO.—Efforts are being made to secure works.

CAMERON, TEX.—Bids are asked until Oct. 25 for constructing works. C. W. Lawrence, Secy.

HILLSBORO, TEX.—It is reported that plans for works are being prepared by D. A. Payor, Dallas, the present artesian supply to be used.

SULPHUR SPRINGS, TEX.—Press reports state that works and an electric light plant will be put in by a private company.

TEMPLE, TEX.—It is proposed to put a pump in the artesian well, to secure an additional daily supply of 400,000 gallons.

TERRELL, TEX.—A committee is investigating the question of supply and how to secure possession of the works, according to press reports.

OAKESDALE, WASH.—The city is reported as figuring on a $24,000 plant.

BAKER CITY, ORE.—The city is trying to secure a gravity supply from the mountains, the present artesian supply not being satisfactory.

NEWBERG, ORE.—The estimated cost of works, with a daily supply of 172,800 gallons from springs, is $11,000.

SANTA CLARA, CAL.—The town board is considering plans and estimates for municipal works.

SANTA ROSA, CAL.—The lowest bid for constructing works, according to reports, was that of Robert Efrey, Mayor, Santa Cruz, at $161,000.

BARTONVILLE, ONT.—The supply for the proposed works, noted last week, would be taken from the Hamilton mains, and the city service may be extended to this place, at an estimated cost of about $5,000.

ARTESIAN WELLS.

TRAVERSE CITY, MICH.—The Thirlby Artesian Well Co. is reported about to sink a well near the jail.

BRENHAM, TEX.—It is reported that bonds will be issued for sinking several wells.

AGNEWS, CAL.—Bids are asked until Oct. 23 for furnishing all materials and boring an artesian well upon the grounds of the state insane asylum. T. S. Montgomery, Secy. Bd. Trustees.

IRRIGATION.

ABILENE, KAN.—T. E. Dewey, of this city, has been appointed receiver of the Southwestern Irrigation Co., which is said to operate 90 miles of ditches in Finney and neighboring counties.

IRVING, KAN.—The Barton County Irrigation Co. has begun the permanent survey and location of the canal to furnish water for the irrigation of 200,000 acres of the Arkansas and Walnut valley and the Cheyenne bottoms.

LOUP CITY, NEB.—Loup and Logan townships have voted a bonus of $24,000 to the Sherman County Irrigation, Water Power & Improvement Co.

DOUGLAS, WYO.—Press reports state as follows: A canal is now being constructed by the Fetterman Canal Co., which is the most important development enterprise ever undertaken in Converse county. The canal taps the North Platte River on its south bank about five miles above Fort Fetterman, and extends down the river for a distance of ten miles. The canal is 14 ft. wide at the bottom, and has a capacity of 150 ft. of water per second. This quantity of water is amply sufficient to irrigate 10,000 acres of land. The Brockaway and other enterprising citizens of this city are behind the enterprise. Three miles of the ditch is already completed, and the promoters of the enterprise hope to have the balance of the ten miles finished by next June.

NEW COMPANIES.—Gothenburg (Neb.) Power & Irrigation Co., Milwaukee, Wis.; $150,000; Wm. C. Quaries, Geo. W. Wilson and C. F. Wenz.——Neligh Irrigation, Power & Mfg. Co., Neligh, Neb.; $100,000; surveys in progress for 15 miles of ditch; M. B. Heuffman, W. T. Wattles, W. C. Estes, J. Maybury and others.——Oasis Ditch Co., Alliance, Neb.; $50,000; F. M. Devare, H. J. and W. G. Simonson.——Wescott Irrigation & Canal Co., Wescott, Neb., $30,000; W. M. Stevens, W. H. Comstock, R. B. Hackney, B. D. Allen and others.

SEWERS.

AMESBURY, MASS.—J. T. Clarkson, Chn. Com., writes us that plans for a system were made about three years ago, but that further action will not be taken till next March.

FAIRHAVEN, MASS.—The selectmen have adopted the Shone system, estimated to cost $61,000, and it is stated that the contract for the construction will soon be awarded.

MEDFIELD, MASS.—The system is to be extended at once. Engr., C. A. Hicks, Needham.

TAUNTON, MASS.—The aldermen have adopted an ordinance for the construction of the Ball system of sewers, at an estimated cost of $60,000.

WOBURN, MASS.—The council has voted to issue $30,000 in bonds for sewers.

SOUTHINGTON, CONN.—It is reported that Stephen Neal has been directed to secure estimates for a system.

ALBANY, N. Y.—Bids are asked until Oct. 15 for constructing a pipe sewer in Myrtle Ave. and a 15 and 6-in. pipe sewer in Pruyn St. T. J. Lanahan, Clk. Bd.

BROOKLYN, N, Y.—Bids are asked until Oct. 18 for constructing sewers in two streets. A. T. White, Comr. Cy. Wks,

BUFFALO. N. Y.—The board of public works has been directed to prepare plans for a sewer in Broadway.

CAZENOVIA, N. Y.—The following bids were received Oct. 3 for constructing the proposed sewer system, recently advertised in Engineering News; Engrs., the Stanwix Engineering Co., Rome, N. Y.:

Beckrich & Fahey, North Tonawanda, N. Y.	$20,870
Peter Morgan, Kingston, N. Y.	24,738
Stratford & Hawks, Brooklyn, N. Y.	25,151
A. F. Nims, Philadelphia, N. Y.	25,987
T. H. Ryan, Coxsackie, N. Y.	26,954
Liphardt & Winterhalter, Detroit, Mich.	27,908
W. G. Smith, Buffalo, N. Y.	27,988
Sawders & Houston, Pittsburg, Pa.	28,045
Dodge & McGregor, Buffalo, N. Y.	28,422
Lindsay & Van Loon, Plymouth, Pa.	29,701
William Fuller, Rochester, N. Y.	29,729
Geo. W. Moore, Buffalo, N. Y.	30,477
Donato Cuozzo, New York	30,636
Ryan & Every, Watertown, N. Y.	31,344
M. Sullivan & Co., Little Falls, N. Y.	31,700
P. Harrison & Sons, New York	33,500
Lauer & Hageman, Rochester, N. Y.	33,781
Thomas Nicholson & Co., Port Huron, Mich.	38,099
Dougherty & Berigen, Yonkers, N. Y.	52,637

FULTON, N. Y.—Reeves Smith, Troy, has been engaged to make surveys and prepare plans for a system.

JAMAICA, N. Y.—The commissioners have voted to adopt the intermittent filtration system of sewage disposal. P. W. Wood, Pres. Comrs.

NEW YORK, N. Y.—Bids are asked by the commissioner of street improvements, 2022 Third Ave., until Oct. 18 for constructing an extension of an outlet sewer in Bungay St. and a sewer in Longwood Ave.

SYRACUSE, N. Y.—The city clerk has been directed to advertise for bids for constructing several pipe sewers.

ORANGE, N. J.—The city engineer estimates the cost of constructing sewers in the remaining streets at $95,250.

TRENTON, N. J.—Bids are asked until Oct. 16 for constructing sewers and drains in several streets. C. E. Murray, Cy. Clk.

WESTFIELD, N. J.—F. A. Dunham, Cy. Engr., Plainfield, has presented plans to the township committee for two separate systems of sewage disposal, one to tide-water and the other for filtration beds.

PITTSBURG, PA.—The committee on public works has recommended that sewers be constructed in 23 streets.

SCRANTON, PA.—The following bids have been received for constructing a sewer in district No. 14: Muldoon & Bowe, $1.67 per lin. ft.; P. J. Moran & Co., $1.57; Howley Bros., $2.23; Dunn Bros., $1.73, or $8,300; U. O'Hara, $1.59; Ferguson & Rooney, $8,480, and Flannigan & O'Hara, $1.44.

ASHTABULA, O.—Contracts for constructing sewers in Lake and Bridge Sts. have been awarded to Geo. McKenzie and E. G. Pullman, at $12,151, and for a sewer in Station St. to S. H. & C. R. De Groodt.

CINCINNATI, O.—Plans have been prepared for sewers in five streets of district No. 2. A. P. Butterfield, Clk., Bd. of Administration.

CLEVELAND, O.—Bids are asked until Oct. 31 for extending the outlet sewer in Erie St. J. H. Farley, Dir. Pub. Wks.

KOKOMO, IND.—The council has passed a resolution to have plans made for a system.

RICHMOND, IND.—The city engineer has been directed to prepare plans for a system south of Main St.

ANN ARBOR, MICH.—G. F. Key, Cy. Engr., informs us that the following bids were received for constructing the sewers recently noted:

	Liberty St.	Washington St.
Porath & Hoeft, Detroit	$7,942	$11,740
Schneider Bros., Ann Arbor	6,735	11,573
John Wagner, Detroit	9,400	13,000
E. W. Groves, Ann Arbor	8,485	14,030
Wetherly & Pulte, Grand Rapids	3,907	6,113
John Keynes, Detroit	7,990	11,271
Liphardt & Weuterhalter, Detroit	4,612	7,159
John Affend & Son, Detroit	5,705	7,471
Stevenson, Reid & Co., Port Huron	*3,449	5,946
John A. Mercer & Co., Detroit	4,600	7,623
Alfred Davis, Saginaw	5,300	7,500
James Hurley & Son, Bay City	6,173	8,900
S. J. Perry, Bay City	4,288	6,177
Beck & Glann, Toledo, O.	4,051	7,671
Hutzel & Co., Ann Arbor	4,500	*5,963
F. G. Goodenaw, Detroit	7,649	11,699
Ulrich, Nissley&Williams, Springfi'd,O.	4,971	8,555

*Awarded contract.

CHICAGO, ILL.—The council has passed an ordinance for constructing sewers in six streets in the district back of the stock yards.

ELGIN, ILL.—D. F. Barclay, W. H. Hintze and R. P. Jackman have been appointed to consider estimates, etc., for a system.

MATTOON, ILL.—Bids are asked until Oct. 16 for constructing a system, according to reports.

DES MOINES, IA.—Bids are asked until Oct. 17 for constructing a 36-in. brick sewer in one street and 18 to 12-in. pipe sewers in four streets. Edward Wright, Chn. Bd. Pub. Wks.

OCONTO, WIS.—Bids are asked until Oct. 17 for constructing about four miles of sewers, as stated in our advertising columns. W. K. Smith, Pres. Bd. Pub. Wks.

WATERTOWN, WIS.—Bids are asked until Oct. 20 for constructing 25,451 ft. of 20 to 8-in. pipe sewers. G. O. Viebahn, Cy. Engr.

HILLSBORO, TEX.—D. A. Payor, Dallas, has been engaged to prepare plans for a system, according to reports.

TAYLOR, TEX.—It is reported that this place is discussing the construction of three miles of sewers, estimated to cost about $10,000.

GRASS VALLEY, CAL.—Plans have been prepared for a system, and it is reported that the citizens will vote on the question of construction in November.

LOS ANGELES, CAL.—The council has passed ordinances for constructing 8-in. pipe sewers in three streets. C. A. Luckenbach, Cy. Clk.

GUELPH, ONT.—The city engineer is preparing a map for a system, and a committee has been appointed to consider the matter. M. O'Connor and G. B. Ryan are interested.

WINNIPEG, MAN.—The committee has voted to advertise for bids for $1,000 worth of sewer pipe.

STREETS.

GLOUCESTER, MASS.—Bids are asked until Oct. 15 for paving Washington St., in Lanesville. B. F. Ellery, Chn. Com.

ALBANY, N. Y.—Bids are asked until Oct. 15 for excavating and filling in Myrtle Ave., and for curbing, flagging and constructing a brick sidewalk in Elk St. T. J. Lanahan, Clk.

BUFFALO, N. Y.—The board of public works has awarded a contract to the Barber Asphalt Paving Co. for paving Longnecker St., at $45,125.

LANSINGBURGH, N. Y.—Bids are asked until Oct. 25 for grading and repaving two streets with cobble stones. George Graham, Village Clk.

NIAGARA FALLS, N. Y.—The contract for paving Main St. with brick has been awarded to J. R. Noblett & Co., at $30,106.

RAHWAY, N. J.—The council has passed an ordinance for paving a portion of Cherry St. with asphalt.

AMBLER, PA.—An election will be held Nov. 6 to vote on an issue of $20,000 in bonds for street improvements and for sewering Rose Valley Creek.

BRUNSWICK, MD.—Surveys are being made by R. A. Rager, Asst. County Engr., Frederick, for improving the streets.

WASHINGTON, D. C.—Bids are asked by the district commissioners until Oct. 12 for grading and regulating streets in East Washington.

JACKSONVILLE, FLA.—The council has passed ordinances for additional brick paving in Bay and Forsyth Sts., estimated to cost $26,821, and for paving in five other streets with alachua rock, estimated to cost $25,000. W. C. West, Recdr.

MEMPHIS, TENN.—The "Scimetar" urges that the board of public works pave Monroe St. with asphalt as a trial.

CINCINNATI, O.—Bids are asked by the Board of Administration until Nov. 5 for paving Clifton Alley with brick and Seventh St. with asphalt.

DAYTON, O.—Bids are asked until Oct. 24 for the purchase of $375,000 of 6% paving bonds, and until Oct. 16 for paving one street with either Medina stone, asphalt blocks, granite or brick. C. A. Herbig, Cy. Comptroller.

NORWOOD, O.—Bids are asked until Oct. 17 for the purchase of $45,214 of 6% street improvement bonds. W. E. Wichgar, Clk.

ST. BERNARD, O.—Bids are asked until Nov. 1 for the purchase of $4,444 of 6% street improvement bonds. J. G. Overmann, Clk.

TOLEDO, O.—Bids are asked until Oct. 26 for paving Platt St. with either Medina stone, cedar blocks, brick or asphalt. L. P. Harris, Cy. Clk.

TORONTO, O.—It is reported that this place is about to pave additional streets.

FORT WAYNE, IND.—The contract for paving Superior and Wells Sts. with brick on 8 ins. concrete foundation has been awarded to Herman Tapp, at $6.80 per lin. ft. on Superior St. and $5.80 on Wells St.

MUNCIE, IND.—Bids are asked until Oct. 22 for constructing a Portland cement sidewalk in Plum St. F. A. Elrod, Cy. Clk.

BENTON HARBOR, MICH.—The court has ordered the St. Josephs & Benton Harbor St. Ry. Co. to pave between its tracks with cedar blocks.

CHICAGO, ILL.—Bids are asked until Oct. 16 for improving portions of seven streets. H. J. Jones, Comr. Pub. Wks.

MILWAUKEE, WIS.—The council has voted to pave a portion of Newbury boulevard with Trinidad Lake asphalt.

BURLINGTON, IA.—The council has voted to advertise for bids for paving two streets with brick. The improvement committee has recommended that contracts be awarded to Geo. Kriechbaum for paving University Place; John Gilbert for grading alley No. 11, between Smith and Market Sts.; A. T. Dankwardt for grading, curbing and paving Ninth north of North Oak, and for paving alley No. 2 from Jefferson to Washington.

DUBUQUE, IA.—Bids are asked until Oct. 15 for macadamizing 4,620 sq. yds., grading 4,500 cu. yds. and for constructing brick, stone or cement sidewalks in 16 streets. W. H. Knowlton, Cy. Engr.

ST. PAUL, MINN.—Bids are asked until Oct. 16 for paving Summit Ave. J. C. Mueller, Clk. Bd. Pub. Wks.

KANSAS CITY, MO.—The board of public works has recommended that a portion of Wyandotte St. be paved with asphalt on concrete.

HOUSTON, TEX.—Bids are asked until Oct. 15 for constructing brick, cement or stone sidewalks in three streets. J. T. Browne, Mayor.

OTTAWA, ONT.—The board of public works has been petitioned to pave Sparks St. with asphalt.

ELECTRIC LIGHT AND POWER.

BROOKLYN, N. Y.—Bids are asked until Oct. 15 for an electric light plant for lighting the Brooklyn bridge cars. C. C. Martin, Ch. Engr. and Supt.

BUFFALO, N. Y.—The five-story brick building, on Niagara St., near Hudson, bought of the Francis estate by the Niagara Power Co., is to be fitted with an electric lighting and steam-heating plant, to cost $10,000. Newcomb Carlton, Elec. Engr., White Bldg., is preparing plans.

NORTH TONAWANDA, N. Y.—Property owners on Delaware St. have petitioned the town board to make a contract for lighting that street with electricity. The street is a new one and reaches from Tonawanda to Buffalo, a distance of 4½ miles.

PLATTSBURG, N. Y.—The village trustees have granted a franchise to the Plattsburg Light, Heat & Power Co.

BERNVILLE, PA.—It is reported that an electric light plant will be put in for public and private lighting.

BRADFORD, PA.—The committee has reported that an electric light plant of 150 arc lights of 2,000 c. p. can be built for $25,000.

DUNCANNON, PA.—An electric light plant will be put in by the borough, or a contract will be given a private company to light the town. S. B. Sheller, Ch. Burgess.

PHILADELPHIA, PA.—The following bids were opened at the bureau of yards and docks, Washington, Oct. 3, for an electric light plant for the League Island Navy Yard:

Westinghouse Electric & Mfg. Co. Pittsburg	$11,816
Crescent Elec. Mach. Co., Brooklyn	9,580
Stern & Silverman, Phila.	$9,572, $10,975 and 14,261
McCay-Howard Engineering Co., Baltimore	9,850
Pennsylvania General Electric Co., Philadelphia	9,998
Geo. S. W. Bunbaker, Dancaster, Pa.	15,900
International Trading & Elec. Co., New York	9,737
L. A. Roche, Philadelphia	8,875

EAST LIVERPOOL, O.—It is reported that this place is to have a new electric light plant.

WAPAKONETA, O.—The council has passed an ordinance for an election in November to vote on an issue of bonds for an incandescent electric light plant.

SEYMOUR, IND.—Bids are asked for gas and electric street lighting. J. E. McKinney, Cy. Clk.

ANN ARBOR, MICH.—Bids are asked until Dec. 1 for 91 arc lights of 2,000 c. p. for one year, each light to burn from sundown to 12:30 a. m., Philadelphia schedule of moonlight lighting. Cy. Engr., Geo. F. Key; Cy. Clk., W. J. Miller.

SPRINGFIELD, ILL.—The council has voted to accept the proposition of the newly organized Citizens' Light Co. for the construction of a municipal electric light plant for the city. The company is to construct immediately a plant and to furnish more than twice as many arc lights as are now in use, and is to receive the appropriations now made for street lighting purposes for five years. Then the plant is to be turned over to the city and will be operated by it.

SANTA FE, N. MEX.—The Santa Fe Gas & Electric Co., which is controlled by the Santa Fe Water & Improvement Co., has made a contract with the General Electric Co. for putting in a 150-HP. generating plant. The plant is to be constructed a half-mile above the city, where water will furnish the power.

VANCOUVER, B. C.—The citizens on Oct. 3 voted to issue $100,000 in bonds for an electric light plant.

NEW COMPANIES.—Summit Electric Light Co., Summit, N. J.; $30,000; Norman Schultz, W. H. Risk, W. J. Curtis.——Lititz Electric Light Co., Manheim, Pa.; $4,200; Treas., H. S. Kauffman; C. Brobst, A. B. Long, P. B. Bucher.——Northern Electric Co., Chicago, Ill.; $25,000; G. W. Turbeck, W. J. Marshall.——Pacific Electrical Co., San Francisco, Cal.; $30,000; W. F. Beckwith, I. E. Rickey, F. H. Kimball.——Mexico Electro-Chemical Reduction Co., Chicago, Ill.; $100,000; C. E. Ridpath, C. E. Plumb, O. R. Barnett.——New Mexico Electro-Chemical Reduction Co., Chicago, Ill.; $100,000; O. R. Barnett, C. E. Ridpath.——Gilpin County Light, Heat & Power Co., Denver, Colo.; $50,000; C. F. Lascombe, T. B. Stearns.——Nokomis Electric Light & Power Co., Nokomis, Ill.; $10,000; R. E. Cornelius, George Bliss.——Helena Power & Light Co., Helena, Mont.; $1,000,000; T. A. Marlow, C. W. Cannon, H. M. Parchen, C. K. Wells.——Thompson-Brown Electric Co., New York; $25,000; Geo. Thompson, Jr., Oyster Bay; M. W. Brown, Hyde Park, Mass.——Mattawa Electric Light & Power Co., Mattawa, Ont.; $10,000; C. Rankin, Dr. C. W. Haentschel, R. Shanks.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

COURTHOUSE.—Waxahachie, Tex.—Bids are asked until Oct. 30 for the erection of a $150,000 courthouse. D. F. Singleton, Judge.

ROCK.—New Orleans, La.—Bids are asked until Oct. 30 for 12,000 tons of rock for improvements near Natchez, Miss. Capt. John Millis, U. S. Engr. Office.

PIER WORK.—Duluth, Minn.—Bids are asked until Oct. 20 for repairing piers at upper entrance, Portage Lake ship canals. Maj. C. B. Sears, U. S. Engr. Office.

GARBAGE CREMATORY.—Steelton, Pa.—The health authorities are reported as considering the question of a crematory for burning garbage.

CANAL IMPROVEMENTS—Albany, N. Y.—Bids are asked until Oct. 23 for 10 contracts for work in connection with the state canals. Edward Hannan, Supt. Pub. Wks.

SEA WALL.—Philadelphia, Pa.—Bids are asked until Oct. 20 for a protection wall at League Island navy yard. Address E. O. Matthews, Ch. of Bureau of Yards and Docks, Washington, D. C.

SURVEYING.—Boston, Mass.—Bids are asked until Oct. 24 for making a topographical survey of the Blue Hills and Middlesex Fells reservations. H. S. Carruth, Secy. Metropolitan Park Comn.

TELEPHONE FRANCHISE—Le Roy, N. Y.—D. J. Bissell has been granted a franchise for a new telephone system and connections. This will displace the present Bell plant, and is expected to be in operation by May 1.

PUBLIC BUILDING.—Rome, Ga.—Bids are asked until Oct. 31 for the construction of a U. S. public building in this city, as stated in our proposal columns. Address Chas. E. Kemper, Acting Supervising Arch., Treasury Dept., Washington, D. C.

PUBLIC BUILDING WORK.—York, Pa.—Bids are asked until Nov. 7 for the interior finish, plumbing and approaches for the U. S. public building in this city. Address Chas. E. Kemper, Acting Supervising Arch., Treasury Dept., Washington, D. C.

LEVEE WORK.—Benton, La.—Bids are asked until Oct. 18 for the construction of a line of levee from Waterloo to Navigation Point, in Bossier parish, about 20 miles below Shreveport, and containing about 130,000 cu. yds. W. H. Hodges, Pres. Bd. Comrs. Bossier Levee District.

DOCKS—Alpena, Mich.—The Alpena & Northern R. R. Co. is reported about to build docks at this place.

PIER WORK.—Ottawa, Ont.—Bids are asked until Oct. 13 for the removal of the whole or a part of the superstructure of the east pier, at Port Dalhousie. J. H. Balderson, Secy. Dept. Rys. and Canals.

DISINFECTING PLANT.—San Diego, Cal.—The following bids were received Sept. 28 at Washington, D. C., for a disinfecting plant at the quarantine station, San Diego: Standard Iron Wks., San Diego, $7,973; Sterne Bros., San Diego, $8,125; Coronado Foundry & Machine Wks., Coronado, Cal., $7,780.

DREDGING.—Syracuse, N. Y.—Specifications are being prepared by the water board for about 24,000 cu. yds. of dredging, at an estimated cost of $12,000.

Wilmington, N. C.—Bids are asked until Nov. 7 for dredging between Beaumont Harbor and New River, N. C., as stated in our advertising columns. Maj. W. S. Stanton, U. S. Engr.

Wilmington, Del.—Bids are asked until Nov. 9 for dredging, as stated in our advertising columns. Wm. F. Smith, U. S. Engr. Office.

DIKE WORK.—Philadelphia, Pa.—Bids are asked until Nov. 5 for repairing and strengthening pile and stone dike, as stated in our advertising columns. Maj. C. W. Raymond, U. S. Engr. Office.

New York, N. Y.—Bids are asked until Oct. 30 for constructing about 200 ft. of dike at Rondout Harbor. 2d Lieut. Robt. McGregor, U. S. Engr. Office.

STATE PENITENTIARY.—Nashville, Tenn.—The following bids were received Oct. 2 for the new state penitentiary:

Fulcher & Dyas, Nashville, Tenn.	$951,659
Bush & Co., Nashville, Tenn.	953,630
Sinott & Co., Nashville, Tenn.	1,101,000
Angus Campbell & Co., Joliet, Ill.	1,122,000
Miles & Bradt, Atlanta, Ga.	1,150,383
Jas. Devault, Columbus, O.	1,360,088

DRAINAGE CANAL.—Rockford, Ill.—Press reports from this city state that a drainage district has been formed in the towns of Milan and Afton, in De Kalb county, and 6,000 acres of swamp land will be drained at a cost of over $35,000. Mr. Starmstrong, a Sycamore surveyor, who has spent several weeks in the service of F. B. Townsend, the Sycamore capitalist, says that the headwaters of the west branch of the Kishwaukee River, in these townships, will be dredged out for a distance of two miles, and several lateral canals will be dug on each side, varying in length from ½ to 1½ miles.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Oct. 12.	Public building,	Allegheny, Pa.	Sept. 20
	Advertised, Eng. News, Sept. 20 and 27.		
Oct. 12.	Removing rock, etc.,	Detroit, Mich.	Sept. 20
Oct. 12.	Highway (6,500 lin. ft.),	Helena, Mont.	Sept. 27
Oct. 12.	Water bonds,	Lyle, Minn.	Sept. 27
Oct. 12.	Water-works system,	Humboldt, Neb.	Sept. 27
Oct. 12.	Water bonds,	Humboldt, Neb.	Sept. 27
Oct. 12.	Sewers,	Brooklyn, N. Y.	Oct. 4
Oct. 12.	Water-works system,	Rossville, Ill.	Sept. 20
Oct. 12.	Levee work,	New Orleans, La.	Oct. 4
Oct. 13.	Sewer pipe, etc.,	Washington, D. C.	Sept. 27
	Advertised, Eng. News, Sept. 27 and Oct. 4.		
Oct. 13.	Pier work,	Ottawa, Ont.	Oct. 11
Oct. 15.	Hire of dredging plant,	Buffalo, N. Y.	Sept. 20
	Advertised, Eng. News, Sept. 20 to Oct. 4.		
Oct. 15.	Dredging,	New York, N. Y.	Sept. 27
	Advertised, Eng. News, Sept. 27 to Oct. 11.		
Oct. 15.	Water bonds ($40,000),	Cuthbert, Ga.	Sept. 27
Oct. 15.	Sewer bonds($500,000),	San Antonio, Tex.	Sept. 27
Oct. 15.	Capitol bldg. foundation,	Olympia, Wash.	Sept. 27
Oct. 15.	Dredging,	Portland, Me.	Sept. 27
	Advertised, Eng. News, Sept. 27 to Oct. 11.		
Oct. 15.	Electric lighting,	Rome, N. Y.	Oct. 4
Oct. 15.	Asphalt paving,	New York, N. Y.	Oct. 4
Oct. 15.	Electric light bonds,	Cuthbert, Ga.	Oct. 4
Oct. 15.	Grading,	New York, N. Y.	Oct. 4
Oct. 15.	Paving,	Gloucester, Mass.	Oct. 11
Oct. 15.	Pipe sewers,	Albany, N. Y.	Oct. 11
Oct. 15.	Electric light plant,	Brooklyn, N. Y.	Oct. 11
Oct. 15.	Sidewalks,	Houston, Tex.	Oct. 11
Oct. 15.	Grading, etc.,	Albany, N. Y.	Oct. 11
Oct. 15.	Macadamizing, etc.,	Dubuque, Ia.	Oct. 11
Oct. 15.	Sidewalks (16 streets),	Dubuque, Ia.	Oct. 11
Oct. 16.	Pumps, etc.,	Beaver Falls, Pa.	Sept. 13
	Advertised, Eng. News, Sept. 13 to Oct. 11.		
Oct. 16.	Dredging,	New York, N. Y.	Sept. 27
	Advertised, Eng. News, Sept. 27 to Oct. 11.		
Oct. 16.	Breakwaters,	New York, N. Y.	Sept. 27
	Advertised, Eng. News, Sept. 27 to Oct. 11.		
Oct. 16.	Steel rails,	Ottawa, Ont.	Sept. 27
Oct. 16.	Sewers,	Brooklyn, N. Y.	Oct. 4
Oct. 16.	Sewers,	Trenton, N. J.	Oct. 11
Oct. 16.	Asphalt brick, etc., paving,	Dayton, O.	Oct. 11
Oct. 16.	Street improvements,	Chicago, Ill.	Oct. 11
Oct. 16.	Sewers,	Mattoon, Ill.	Oct. 11
Oct. 16.	Paving,	St. Paul, Minn.	Oct. 11
Oct. 17.	Electric lighting,	Oswego, N. Y.	Sept. 20
Oct. 17.	Riprap stone,	Washington, D. C.	Sept. 20
	Advertised, Eng. News, Sept. 20 to Oct. 11.		
Oct. 17.	Dredging,	Washington, D. C.	Sept. 20
	Advertised, Eng. News, Sept. 20 to Oct. 11.		
Oct. 17.	Paving bonds ($45,214),	Norwood, O.	Oct. 11
Oct. 17.	Sewers (4 miles),	Oconto, Wis.	Oct. 11
	Advertised, Eng. News, Oct. 11.		
Oct. 17.	Pipe sewers,	Des Moines, Ia.	Oct. 11
Oct. 18.	Dredging (360,000 cu. yds.),	New York.	Sept. 27
Oct. 18.	Pile revetment (500 ft.),	New York, N. Y.	Sept. 27
Oct. 18.	Water-works system,	Gibson City, Ill.	Oct. 4
	Advertised, Eng. News, Oct. 4 and 11.		
Oct. 18.	Water-works system,	Vandalia, Ill.	Oct. 4
	Advertised, Eng. News, Oct. 4 and 11.		
Oct. 18.	Sewers,	Brooklyn, N. Y.	Oct. 11
Oct. 18.	Sewers,	New York, N. Y.	Oct 11
Oct. 18.	Levee work,	Benton, La.	Oct. 11
Oct. 19.	Jail cells, etc.,	Auburn, Cal.	Sept. 27
Oct. 19.	Sidewalks,	Piqua, O.	Oct. 4
Oct. 20.	Artesian well,	Fargo, N. Dak.	Oct. 4
Oct. 20.	Sea wall,	Philadelphia Navy Yard	Oct. 11
Oct. 20.	Pipe sewers (25,451 ft.),	Watertown, Wis.	Oct. 11
Oct. 20.	Pier work,	Duluth, Minn.	Oct. 11
Oct. 20.	Water-works system,	Eagle Grove, Ia.	Oct. 11
	Advertised, Eng. News, Oct. 11 and 18.		
Oct. 20.	Macadamizing,	Kansas City, Mo.	Oct. 11
Oct. 22.	Water supply,	Jersey City, N. J.	Sept. 20
Oct. 22.	Ledge work,	Boston, Mass.	Sept. 27
	Advertised, Eng. News, Sept. 27 to Oct. 11.		
Oct. 22.	Water bonds ($15,000),	Attica, O.	Sept. 27
Oct. 22.	Pipe sewers, (4,000 ft.),	Warren, O.	Oct. 4
Oct. 22.	Cement sidewalks,	Muncie, Ind.	Oct. 11
Oct. 23.	Approaches, etc.,	Detroit, Mich.	Sept. 27
	Advertised, Eng. News, Sept. 27 and Oct. 4.		
Oct. 23.	Grading, etc.,	Helena, Mont.	Oct. 4
Oct. 23.	Artesian well,	Agnews, Cal.	Oct. 11
Oct. 23.	Bridges,	Albany, N. Y.	Oct. 11
Oct. 23.	Canal improvements,	Albany, N. Y.	Oct. 11
Oct. 24.	Heating apparatus,	New Haven, Conn.	Sept. 27
	Advertised, Eng. News, Sept. 27 and Oct. 4.		
Oct. 24.	Model barges,	St. Louis, Mo.	Oct. 4
	Advertised, Eng. News, Sept. 27 to Oct. 11.		
Oct. 24.	Topographical survey,	Boston.	Oct. 11
Oct. 24.	Paving bonds ($375,000),	Dayton, O.	Oct. 11
Oct. 25.	Granite,	St. Augustine, Fla.	Sept. 27
	Advertised, Eng. News, Sept. 27 to Oct. 18.		
Oct. 25.	Jetty work,	New Orleans, La.	Oct. 4
Oct. 25.	Repaving,	Lansingburg, N. Y.	Oct. 11
Oct. 25.	Iron hoist bridge,	Dayton O.	Oct. 11
Oct. 25.	Water-works system,	Cameron, Tex.	Oct. 11
Oct. 25.	Water-works,	Cambridge City, Ind.	Oct. 11
	Advertised, Eng. News, Oct. 11 and 18.		

Oct. 26. Stone, cedar or brick paving, Toledo...Oct. 11
Oct. 26. Grading (2½ miles), Kansas City, Mo...Oct. 11
Oct. 26. Macadamizing (1½ miles), Kansas City..Oct. 11
Oct. 27. Drainage, Mount Vernon, N. Y.....Oct. 4
Advertised, Eng. News, Oct. 4 and 11.
Oct. 27. Grading, Kansas City, Mo.....Oct. 11
Oct. 29. Dredging and jetty work, New Orleans. Oct. 4
Oct. 30. Dike work, New York, N. Y.....Oct. 11
Oct. 30. Rock, New Orleans, La.....Oct. 11
Oct. 30. Courthouse, Waxahachie, Tex.....Oct. 11
Oct. 31. Drawbridges, Chicago, Ill.....Sept. 6
Advertised, Eng. News, Sept. 6 and 20.
Oct. 31. Bridge masonry, Chicago, Ill.....Sept. 6
Advertised, Eng. News, Sept. 6 and 20.
Oct. 31. Public building at Rome, Ga.....Oct. 11
Advertised, Eng. News, Oct. 11 and 18.
Oct. 31. Outlet sewer ext'n, Cleveland, O.....Oct. 11
Nov. 1. Dredging, piers, etc., Milwaukee, Wis. Oct. 4
Advertised, Eng. News, Oct. 4 to 25.
Nov. 1. Paving bonds ($4,444), St. Bernard, O..Oct. 11
Nov. 2. Dredging, Philadelphia, Pa.....Oct. 4
Advertised, Eng. News, Oct. 4 to 25.
Nov. 5. Dike work, Philadelphia, Pa.....Oct. 11
Advertised, Eng. News, Oct. 11 to Nov. 1.
Nov. 5. Asphalt paving, Cincinnati, O.....Oct. 11
Nov. 6. Filter Plant, Beaver Falls, Pa.....Oct. 11
Advertised, Eng. News, Sept. 13 to Oct. 11.
Nov. 6. Breakwater and piers, Milwaukee, Wis. Oct. 4
Advertised, Eng. News, Oct. 4 to 25.
Nov. 7. Public building work at York, Pa.....Oct. 11
Advertised, Eng. News, Oct. 11 and 18.
Nov. 7. Dredging, Wilmington, N. C.....Oct. 11
Advertised, Eng. News, Oct. 11 to Nov. 1.
Nov. 5. Brick paving, Cincinnati, O.....Oct. 11
Nov. 7. Water bonds, Arlington Heights, O.....Oct. 11
Nov. 9. Dredging, Wilmington, Del.....Oct. 11
Advertised, Eng. News, Oct. 11 to Nov. 1.
Dec. 1. Electric lighting, Ann Arbor, Mich.....Oct. 11
No date. Canal work, Los Angeles, Cal.....Sept. 13
Advertised, Eng. News, Sept. 13 to Oct. 18.
" " Macadamizing, Columbus, O.....Oct. 11
" " Street lighting, Seymour, Ind.....Oct. 11

CONTRACT PRICES.

BRIDGES.—New Brunswick, N. J.—The freeholders of this county have awarded the contract for a new iron bridge across the Raritan River at this place to the Penn Bridge Co., Beaver Falls, Pa. The bridge will be 362 ft. long, three spans, 18-ft. roadway and one 5-ft. sidewalk, and will weigh, including handrails, 338,000 lbs. Consult. Engr., Geo. H. Blakely, of the Passaic Rolling Mill; Ch. Engr., Asher Atkinson, Engr. Middlesex County. The bids were as follows:

	Asphalt floor.	Wood floor.
King Bridge Co.,	$25,118	$15,823
Penn Bridge Co.	21,171	12,490
Youngstown Bridge Co.	22,725	12,949
W. T. Kirk Bridge Co.	20,735	12,835
Massillon Bridge Co.	20,500	14,000
Wrought Iron Bridge Co.	24,285	13,724
Groton Bridge Co.	19,613	12,779
Rochester Bridge Co.	23,531	14,992
New Jersey Steel & Iron Co.	23,249	13,346
Boston Bridge Co.	21,557	15,457
Horsehead Bridge Co.	20,610	13,375
Nelson & Buchanan	27,700	16,753
Phil. Weigel	24,966	16,986

Cincinnati, O.—The contract for constructing a new stone or concrete bridge over Park Ave., in Eden Park, has been awarded to the Melan Arch Construction Co., New York; bridge to be of 70-ft. span, 34 ft. wide and 120 ft. long over all, and is to be completed in 60 days; plans drawn by Fr. von Emperger, Consult. Engr., New York. The bids were as follows:

	Excav., cu.yd.	Total.
Branham, Geat & Co.	$0.50	$9,850
Melan Arch Construction Co.	.75	7,130
Michael Stopper	.75	12,207
Branham, Geat & Co. (Chase plan)	.50	10,005
Wilson Strack	.75	10,750
Joseph McMurray	.25	10,200
L. J. Osborn, Jr.	.35	8,500
Jos. McMurray (Melan plan)	.25	9,615

REPAIRING BRIDGE PIERS—Washington, D. C.—The contract for repairing the piers of the Aqueduct bridge, for which $51,000 was appropriated, has been awarded to the Shaller & Schniglau Co., Chicago, at $36,375, divided as follows: $24,000 for building a coffer-dam around pier No. 4; $30 per cu. yd. for 203 cu. yds., for placing concrete around the base and sides of this pier; $25 per cu. yd. for 87 cu. yds. of concrete to repair piers 2, 3, 5, 6, 7 and 8, and $1,500 for the removal of the coffer-dam.

SEWERS.—Union, N. J.—Robert Gaw, Weehawken, Engr. town of Union, writes us that the following bids were received for constructing the big lateral sewer:

Items.	O'Toole, Hopkins & Reagan.	Henry & McGlivliney.	Feeney & Cavanagh.
50 x 75-in., 2,300 lin. ft., per lin. ft.	$5.18	$9.00	$7.90
48-in., 500 lin ft., per lin. ft.	4.30	8.00	7.55
40 x 60-in., 500 lin. ft., per lin. ft.	4.62	8.00	7.50
24 x 36-in., 400 " " "	3.00	6.00	4.75
36-in., 500 lin. ft., per lin. ft.	3.60	7.00	5.50
30-in., 600 " " "	3.50	6.00	4.95
24-in., 900 " " "	3.00	4.00	3.75
Manholes, 60, each	45.00	66.00	75.00
Receiving basins, 26, each	90.00	70.00	125.00
Timber, 50 M. ft., per M. ft.	24.00	3.00	25.00
Cradle, 50 M. ft., " "	20.00	5.00	25.00
6-in. house con's, 500 lin.ft., per lin.ft.	.25	.55	.50
Rock, 20,000 cu. yds., per cu. yd.	7.45	4.70	6.50
18-in. pipe, 300 lin. ft.	1.85	3.00	1.50
18-in. " relaid, 400 lin. ft.	1.25	1.22	1.00

The sewer will be a very difficult job for the contractors, as there will be cuts of 25 ft. in a street 60 ft. wide built up on both sides, and about 3,600 ft. of the sewer has to be built under the sidewalk, which is 10 ft. wide, with a large silk factory and houses on the street line. The sale of bonds is to be advertised immediately.

Utica, N. Y.—The contract for a 20-in. vitrified pipe sewer in Whitesboro St. has been awarded to John Hughes, at $1.15 per lin. ft. for the sewer, $1.12 for each branch, 15 cts. per lin. ft. for 6-in. house connections, $39 for each manhole, $26 per M. ft. for pine plank, $13 for hemlock lumber in foundation, $4.50 per cu. yd. for concrete, $3 per lin. ft. for 20-in. cast iron pipe.

Brooklyn, N. Y.—The following bids were received last week for constructing a cement pipe sewer:

	Pipe, per ft. 12-in.	15-in.	Manholes, each.
M. F. Hickey	$1.00	$1.35	$30.00
James Jennings	.87	1.15	31.00
Harris & Maguire	.87	1.09	30.00
Richard Whalen	.79	1.25	32.00

Niagara Falls, N. Y.—The following bids were received Oct. 5 for constructing the Buffalo Ave. sewer system:

Items.	A. F. Allen & Co.	R. D. Young.	P. P. Smith.	John S. Pierce & Co.	Philpott & Makin.	Clement & Co.
36-in. brick, 1,368 ft.	$3.29	$4.72	$5.00	$3.95	$4.13	$4.00
30-in. " 688 ft.	2.84	3.90	3.85	3.75	2.96	3.30
24-in. " 363 ft.	2.56	3.36	2.95	3.50	2.70	2.80
15-in. tile, 463 ft.	.80	1.33	1.55	2.35	1.45	1.15
12-in. " 948 ft.	.83	.98	1.10	2.40	1.00	.82
Rock exc., 4,320 yds.	2.64	2.57	2.50	2.25	2.60	2.04
Catch basins, 17	39.52	40.00	55.00	40.50	45.00	40.50
Manholes, 7	45.00	40.00	65.00	34.00	40.00	35.00
Concrete, per cu. yd.	3.50	3.50	5.00	3.00	6.50	8.00

The bids for work in district No. 2 were as follows:

	Tile, 18-in.	Tile, 10-in.	Rock excav.	Catch basins.	Manholes.
Clement & Co.	$.80	$.51½	$2.57	$39.52	$39.40
Philpott & Makin	.85	.53	2.50	49.50	39.00
Anthony Ross	1.25	1.20	2.50	55.00	35.00
John S. Pierce & Co.	.95	.59	2.50	50.00	40.00
James Watson & Son.	3.25	2.25	2.25	40.50	34.00
B. P. Smith	.55	.45	2.50	35.00	35.00
P. Moncini	.90	.70	2.40	40.00	35.00
A. F. Allen & Co.	.85	.60	2.00	40.50	30.00

GRADING.—Allentown, Pa.—Contracts for grading two streets have been awarded to Dorney & Hartzell, at 16 cts. per cu. yd., and Schuyler & Stirk, at 17 cts.

ASPHALT PAVING.—Brooklyn, N. Y.—The only bid received Oct. 2 for repaving in two streets with asphalt was that of Crawford & Co., at $2.28 per sq. yd. for paving with Trinidad Lake asphalt, 28 cts. per sq. yd. for repairing and relaying cobblestone paving, 30 cts. per lin. ft. for resetting curb and relaying crosswalks, 20 cts. per lin. ft. for redressing old curb, including corner stones, 65 cts. for new curb, and 35 cts. per sq. ft. for new bridge stones.

STONE PAVING.—Jersey City, N. J.—The following bids were received for repaving in two streets with Belgian blocks:

	Earth filling, per cu. yd.	Pvg., per sq. yd.	New Bridge curb, per lin. ft.	stone, per sq. ft.	Rpvg., per sq. yd.	Recvg. basins, each.
John Nolan	$.01	$1.38	$.40	$.45	$.12	$50
Dennis Byrnes	.05	1.35	.35	.40	.15	75
Chas. Trainer	.35	1.38	.55	.50	.18	75
Patrick Flaherty	.05	1.32	.44	.35	.40	50
J. J. Hartington	.01	1.24	.29	.29	.20	90
John Callery	.30	1.49	.50	.60	.40	100
Henry Byrne	.05	1.30	.45	.60	.30	100
Ed. O'Donnell	.10	1.29	.35	.42	.32	90
J. J. Shea	.05	1.32	.45	.50	.20	80

Newark, N. J.—The contract for paving Second Ave. with oblong trap rock blocks has been awarded to Arthur E. Sandford at $1.77 per sq. yd.; total bid, $10,596.——The contract for paving Academy St. with granite blocks on concrete was awarded to Terence McManus, at $2.98 per sq. yd.

WATER MAIN.—Pittsburg, Pa.—The following bids were received last month for furnishing and laying 1,300 ft. of 50-in. riveted steel rising main, and 40 and 36-in. cast iron pipe connections, with specials complete: Riter & Conley, $24.50 per lin. ft.; James McNeil & Bro., $22.72; E. C. Mayham, $22.65.

ELECTRIC LIGHT PLANT.—Toronto, Ont.—The bids recently received for lighting the streets by electricity or gas were published in our issue of Sept. 27. Some of the bids for the municipal electric light plant, for which bids were received at the same time, as advertised in Engineering News, were as follows: Engine equipment, three 500 HP.—Ranken & Fritsch, $39,000 for triple-expansion vertical Corliss engines; $34,750 for compound vertical engines; $37,500 for four-cylinder, triple-expansion, horizontal engines; $32,000 for cross-compound horizontal; $28,500 for horizontal, tandem compound engines; $1,250 extra if steam jackets are wanted with triple-expansion engines; $750 extra for steam jackets with compound engines; Erie City Iron Works, $19,995; John Inglis & Son, $25,500 for cross-compound Corliss; $28,000, ditto, Poppet (Nordberg); $33,000 for four-cylinder, triple-expansion Corliss; $37,200, ditto, Poppet (Nordberg); John Macdougall, $35,000; Bertram Engine Works, $72,500, including countershaft and pulleys, belting, boilers, feed pumps and condensers, water and steam piping, and economizers; $2,310 extra for vertical air pumps; $5,800 extra for triple-expansion engines. Boilers—Abendroth & Root Mfg. Co., $24,300 (informal); Erie City Iron Works, $21,199; John Inglis & Son, $23,500 for marine, water back, and $22,600 for dry back; Aultman & Taylor, $16,000 for five Cahall vertical water-tube boilers; Babcock & Wilcox, $14,167 for three boilers; $21,688 for seven; Heine Safety Boiler Co., $20,775 for seven 150-HP. boilers; John Macdougall, $23,695. Dynamos and station electric apparatus and 1,300 arc lamps—Standard Electric Co., $42,500 for 20 arc dynamos and $35,075 for lamps; Siemens & Halske, $24,500, and lamps at $20 each; Brush Electric Co., $29,200 for 15 100-light dynamos or $27,200 for 12 125-light dynamos, and $23,900 for lamps; Canadian General Electric Co., $37,554 for 19 80-light dynamos, and $49,940 for lamps; Excelsior Electric Co., $72,930 or $68,640, both bids including lamps; Western Electric Co., $34,700 for 15 100-light dynamos or $29,850 for 12 125-light dynamos, and $29,645 for single carbon lamps or $34,750 for double carbon lamps.

DREDGING.—Boston, Mass.—Lieut.-Col. S. M. Mansfield, U. S. Engineer Office, received the following bids Oct. 4 for dredging, (1) being the price per cubic yard for work in Essex River, (2) in Mystic and Malden rivers, and (3) in Powow River:

	1.	2.	3.
Eastern Dredging Co., Portland	$0.32	$0.33½	..
A. B. Martin, Boston	.29½	.35	..
Columbian Dredging Co., E. Boston	.19	..	$0.44½
Rittenhouse Moore, Mobile, Ala.	..	.34	.44
Chas. H. Souther, Boston	..	.23⅞	..
A. R. Wright, Portland	..	..	.39

Washington, D. C.—The following bids were received at the U. S. Engineer Office for dredging in York River; the price being per cubic yard:

Virginia Dredging Co., Richmond	$0.41
New York Dredging Co., New York	.14
Baltimore Dredging Co., Baltimore	.34
C. T. Caler, Norfolk, Va.	.40
Henry Wilson, Washington, D. C.	.13
Rittenhouse Moore, Mobile, Ala.	.20

RUBBLESTONE.—Boston, Mass.—The following bids were received by Lieut.-Col. S. M. Mansfield, U. S. Engineer Office, Oct. 4, (1) being the price per ton of 2,000 lbs. for rubblestone for breakwater at Sandy Bay, Cape Ann, (2) for south jetty, Newburyport Harbor, and (3) for breakwater in Gloucester Harbor:

	1.	2.	3.
Pigeon Hill Gran. Co., Rockport, Mass.	$0.69	$1.27	$0.94
Cape Ann Granite Co., Boston, Mass.	.597	..	.89
Joseph H. White, Boston	..	1.39	1.09
Seth Perkins & J. E. White, Boston.	..	..	.97
Rockport Granite Co., Rockport, Mass.	.61	1.23	.87
George W. Andrews, Biddeford, Me.	.81	1.33	1.07
Hughes Bros. & Bangs, Syracuse, N. Y.	.77	1.53	1.42
Lanesville Gran. Co., Rockport, Mass.	..	..	.99½

PIPE.—Albany, N. Y.—The following bids were received Oct. 3 for about 200 gross tons of 12 to 6-in. cast iron water pipe, according to reports: Camden Iron Wks., $22.35 per ton for pipe and 2¼ cts. per lb. for special castings; M. J. Drummond, $23.50 and 2½ cts.; Anniston Pipe Wks., $24 and 2⅝ cts.; McNeal Foundry & Pipe Co., $24 and 2 2-5 cts.

BRICK PAVING.—Cincinnati, O.—A local paper states that the lowest bid for paving Evans St. with brick was at 98 cts. per sq. yd. for the paving and $2.50 per cu. yd. for concrete, also that the prevailing prices for similar work one year ago were $2 per sq. yd. for paving and $4.50 per cu. yd. for concrete.

Niagara Falls, N. Y.—The board of public works has recommended that the contract for paving the extension of Main St. with brick be awarded to John E. Noblett & Co., Niagara Falls, at $2.18 per sq. yd. for Park brick. The other bidders were: R. D. Young, J. W. Ward, B. P. Smith & Co. and Pierce & Dean, of this city; Park Paving Co., of Rochester, Pa.; Beckrich & Fay, Rogers Construction Co., W. E. Warren and Louis H. Gipp, of Tonawanda.

Lincoln, Neb.—The following bids were received for paving portions of three streets with two courses of brick upon sand: St. Joe Paving Brick Co., $1.64 per sq. yd.; Krone & Anderson, $1.68½; McDonald & Cagney, $1.69½; Buckstaff Bros., $1.74.

Burlington, Ia.—A contract for paving with two courses of brick has been awarded to Geo. Kriechbaum, at $1.45 per sq. yd.; curbing, 50 cts. per lin. ft.

Easton, Pa.—The contract for paving the Jordan bridge with Metropolitan vitrified brick, made at Canton, O., has been awarded to A. M. Stephens, at $2.18 per sq. yd.

Joliet, Ill.—The following bids were received for paving Cass St. with brick: Dennis & Campbell, Galesburg brick, $1.31½ per sq. yd., Streater brick (if they can be furnished), $1.21½; Ottawa, No. 1, $1.20; curbing, including all excavation and back filling, 15 cts. per lin. ft.; catch basins, pipe, etc., $30 per cu. yd. in stone, and $28 in gravel or earth; paving cement in work, 20 cts. per gallon; gravel in work, 75 cts. per cu. yd.; excavation, 20 cts. per cu. yd.; old curbing, including taking up and resetting, 10 cts. per lin. ft.; T. P. Townsend Co., Zanesville, O., brick, $1.20 per sq. yd.; $16 per 1,000 ft. for pine; $14 for hemlock; catch basins, $20 each; paving cement, 15 cts. per gallon; gravel in work, 75 cts. per cu. yd.; excavation, 30 cts.; taking up and resetting old curbing, 20 cts.

METAL MARKET PRICES.

LEAD.—New York: 3.15 to 3.17 cts. Chicago: 3 cts.; St. Louis: 2.9 to 2.95 cts.

NAILS.—Pittsburg: $1 for wire, and 85 cts. for cut at mill, in carload lots.

BARBED WIRE.—Pittsburg: galvanized, $2.10; plain, $1.25 for carload lots at mill.

FOUNDRY AND PIG IRON.—New York: $10.50 to $13. Pittsburg: $10.75 to $12. Chicago: $9.50 to $10.50.

TRACK MATERIAL.—New York: angle bars, 1.25 to 1.4 cts.; spikes, 1.55 to 1.7 cts.; track bolts, 2 to 2.1 cts. with square, and 2.15 to 2.3 cts. with hexagon nuts. Chicago: angle bars, 1.25 to 1.35 cts.; spikes, 1.65 to 1.75 cts.; track bolts, 2.1 to 2.2 cts., with hexagon nuts.

RAILS.—New York: $24 at eastern mills and at tidewater; old rails, $11.50 to $12 for iron and $9 to $9.50 for steel; steel rails, fit for relaying, $16 to $19; light rails, $22 to $24; girder rails, $24. Pittsburg: $24 for standard sections. Chicago: $25 to $27; old rails, $11 to $11.50 for iron and $7.50 to $11 for steel.

STRUCTURAL MATERIAL.—New York: beams, 1.3 to 1.5 cts.; channels, 1.4 to 1.5 cts.; angles, 1.3 to 1.35 cts.; tees, 1.5 to 1.6 cts.; universal mill plates, 1.25 to 1.35 cts.; steel plates, 1.3 to 1.4 cts. for tank, 1.4 to 1.5 cts. for shell, 1.6 to 1.65 cts. for flange, 1.75 to 2 cts. for ordinary firebox, 2 to 2.25 cts. for locomotive firebox. Pittsburg: beams, 1.25 to 1.35 cts.; channels, 1.25 to 1.35 cts., angles, 1.15 to 1.2 cts.; tees, 1.35 cts.; universal mill plates, 1.15 to 1.2 cts.; tees, steel plates, 1.2 to 1.25 cts. for tank, 1.25 to 1.35 cts. for shell, 1.3 to 1.4 cts. for flange, 2.5 to 3.75 for ordinary firebox, and 3.35 to 3.5 cts. for locomotive

firebox. Chicago: beams, 1.5 cts.; channels, 1.5 cts.; angles, 1.4 to 1.45 cts.; tees, 1.65 cts.; universal plates, 1.4 to 1.45 cts.; steel plates, 1.4 to 1.5 cts. for tank, 1.65 to 2.1 cts. for flange, 1.65 to 5 cts. for firebox.

IRON AND STEEL.—The "Journal of Commerce," of New York, reports that Eastern consumers are placing only very commonplace orders for American pig iron, and the entire business in this quarter makes a rather poor showing. Among sellers there is live competition, and concessions of 25 to 50 cts. from the popular quotations are frequently made. In Scotch pig there is no business outside of an occasional 25-ton trade. Spiegeleisen and ferro-manganese remain dull, owing to the poor condition of the steel trade. Operations in old material are still on a moderate scale, and practically at former prices. In steel rails and track fastenings the dealings are still light for the season, and the demand is without perceptible improvement. Other heavy material is finding only moderate sale and prices continue low.

INDUSTRIAL NOTES.

THE HEATH RAIL JOINT CO., of South Chicago, Ill., has an order for joints for 70 miles on the Atchison, Topeka & Santa Fe Ry.

FRASER & CHALMERS, of Chicago, Ill., have a contract for four engines for the electric equipment of the West Chicago Street Ry. Co. Three will be of 2,000 HP. and one of 1,000 HP.

POST & JACOBI, Chicago, Ill., have begun the manufacture of drawing materials and engineering and drawing instruments of all kinds. The offices of the firm are at 60 and 61 Lakeside Building.

THE THOMSON METER CO., of Brooklyn, N. Y., is sending out a souvenir inkstand in the shape of one of its ¾-in. Bee water meters, the internal mechanism of course being omitted. The company has sold 57,555 meters to date.

THE BLOOMSBURG CAR MFG. CO. is the new name of the Bloomsburg Car Co., of Bloomsburg, Pa. The capital stock is $200,000. The incorporators are John K. Lockhard, George M. Lockhard and Richard W. Oswald, all of Bloomsburg.

THE C. W. HUNT CO., of New York, is installing at the Everett Mills, Lawrence, Mass., a complete system of narrow-gage tracks and cars for handling materials. The Hunt system of industrial railways was described in our issue of June 16, 1892.

THE JEFFREY MFG. CO., of Columbus, O., has orders for two electric locomotives for the Pennsylvania anthracite regions. One is from the Westminster Coal Co., of Wilkesbarre, for a 40-HP. mine locomotive, with 2,000 lbs. drawbar pull at 8 miles per hour. The other is from John Jermyn, of Scranton, for a 60-HP. mine locomotive, with 3,000 lbs. drawbar pull at 8 miles per hour.

THE WAKEFIELD SHEET PILING CO., of Chicago, has the contract to supply its sheet piling for the large cofferdam which will be built in repairing the piers of the aqueduct bridge at Georgetown, D. C., which were injured by the ice last winter. This cofferdam will be about 400 ft. long and in a depth of 30 ft. of water. Mr. J. A. Wakefield will superintend the erection of the cofferdam for Shaller & Schniglau, of Chicago, the contractors.

THE PENNSYLVANIA STEEL CO., of Steelton, Pa., held its annual meeting in Philadelphia on Oct. 3. Mr. E. B. Morris and Luther S. Bent, the Receivers of the company, presented a report showing a net profit of $150,000 in the past year, notwithstanding the reduction of output to one-half, for several months, due to the coal and coke strikes. It was announced that 94% of the creditors and all the stockholders had signed the reorganization plan, and $1,750,000 had been subscribed for the $1,500,000 of preferred stock.

THE PRESCOTT STEAM PUMP CO., of Milwaukee, Wis., has leased the buildings at the corner of Oregon and Barclay Sts., and is fitting them up with entirely new machinery for manufacturing a high class of pumps of all kinds, paying especial attention to pumps for mine work. The company now has pumps in use at the Norrie Mine at Norwood, Mich., the Chandler Mine, at Ely, Minn., and the Montreal Mine at Hurley, Wis., besides several smaller plants. The officers of the company are Fred. H. Prescott President, and H. L. Perrine Superintendent, and H. L. Perrine Chief Engineer.

NEW COMPANIES.—Ohio Building Co., of Wellston, O.; $10,000; Joseph Gooding, A. W. Thomson and J. C. H. Cobb.——Pike Dredging & Amalgamating Co., Helena, Mont.; $1,000,000; Charles A. Porter and Col. O. C. Bosbyshell, of Philadelphia, Pa., and J. S. Sanderson, of Springfield, Mass.——Ash Automatic Electric Switch Co., Newark, N. J.; $250,000; Walter V. Ash, Joseph Samuel and Moses Hirsh.——Houston Pressed Brick & Tile Co., Houston, Tex.; $30,000; Andrew Thalson and E. A. McMait.——State Construction Co., Chicago, Ill.; $250,000; Geo. M. Stevens and Wm. C. Crafts.——Economic Smoke Preventing Furnace Co., Chicago, Ill.; $200,000; W. H. Braine, J. W. Chaffee and P. K. Mahn.——James B. Clow & Sons, Chicago, Ill.; sanitary appliances; $250,000; James B. Clow and J. M. Johnson.——Western Corundum Co., Chicago, Ill.; $200,000; M. E. Strack, Robert T. Clark and M. B. Dean.

NOTES OF THE MACHINERY MARKET.

Within the last few weeks New York dealers in machinist tools and engineers' supplies have noticed an increase in trade that gives them much encouragement. The absolute stagnation which has reigned for so many months at last appears to be broken. As an instance of what leading firms are doing, the Niles Tool Works Co. has recently secured a contract to equip the Boston & Albany Railway shops at West Springfield with $49,000 worth of machinery. The contract calls for a general list of heavy machine tools, of which this firm makes a specialty. This is the largest order the Niles people have received for over six months. The same firm was within the last week the lowest bidder for a $25,000 lot of machine tools for the Washington navy yard. In all probability the Niles Co. will be awarded this contract, and with the other orders which are coming in for smaller lots of machinery the firm is well satisfied with the present state of the machine tool trade.

The reduction in the price of machine tools, engineers' supplies and iron work generally requires manufacturers to make diligent study as to the most economical methods of manufacture. Raw material is cheap, so that does not bother them. New inventions and improved systems of manufacture are continually reducing the cost of production; but wages are considered to be abnormally high for the times, and they will have to be cut somewhat to put the machinery business on a permanently profitable basis. The list price of a 6-ft. boring mill, miles make, is now $3,300, which is 10% lower than the price of a year ago. The Pratt & Whitney list price for a 14-in. shaping machine is $500, a reduction of 25% from last year's figures. Screw machines are 10 to 15% below former rates, and so it is with all sorts of engineers' supplies. When trade discounts and other necessary business cuts in prices are subtracted from these quotations, it is seen that there is little margin left for profit.

The Pratt & Whitney Co. is doing a brisk business in bicycle machinery. The company makes a special type of screw machine and multiple drill for this class of work. Besides their work in this country they are equipping several bicycle plants abroad. Manning, Maxwell & Moore report a fair general demand for engineers' supplies from the West and South, principally from the latter section of the country. The decreases in railway earnings have naturally adversely affected the injector trade. The Nathan Manufacturing Co. say that the injector business has not yet had a trade revival, though it shows some signs of life.

Both the Knowles pump and the Blake pump representatives report a steady improvement in business, but make no mention of any large contracts. In turbines James Leffel & Co. are making important sales to a wide range of territory. They are shipping wheels for electric plants to many European countries. There is now every prospect that New York dealers in engineers' supplies will have a moderate but substantial trade during the fall and winter.

MUNICIPAL BOND MARKET.

New York, Oct. 9, 1894.

It was noted in these columns last week how, despite the dullness marking for some weeks now the financial world, the continued absorption of municipal bonds has been of such a degree as to make it the most prominent feature of the financial situation. Since the first of October even this demand, noticeably large as it has been, has been increased by reason of the seeking for investment of the dividend and interest payments distributed on that date. Quite a number of corporations put money into circulation at this period by having coupons due then, and this amount runs way up into the millions. Just why municipal bonds should feel the greatest benefit from the big sums of money in search of investment is well put forth in what Messrs. E. H. Gay & Co., the Boston dealers in municipal bonds, have to say. This is the house noted in these columns last week as having purchased $100,000 Salt Lake City, Utah, 5 per cent. bonds. Say the Boston bankers:

"It is significant that throughout this trying period (referring to the depression of the past summer) the record of prompt payment of interest on municipal bonds is unimpaired. It is a well-known fact that in estimating future income from their investments, insurance companies make it a practice to allow for 'fall in the rate of interest.' The propriety of this course is borne out by experience, which has demonstrated that the rate of interest per annum tends constantly to fall—commensurate with a country's development and its accumulation of wealth. Thus, money in the London market is to-day offered in large volume at 1¼ to 1 per cent. on call and at ½ and ⅝ of 1 per cent. on short time, while prime railroad liens yield the English investor but about 2½ per cent. annual income. A comparison of these returns with those received from high grade Americans shows a large variance and demonstrates that the latter have still far to advance before reaching a parity with English investments. In view of these facts and the large and prospective volume of funds seeking safe and remunerative employment in this country, we look for continued demand and higher prices for this class of securities—municipal bonds."

Judged by these expert opinions, the future of the municipal bond market is full of promise. In January some $100,000,000 will be distributed in New York, Boston, Philadelphia and Chicago. All this will seek re-investment, and municipal bonds will be preferred. At present the market is practically bare of good bond issues, and there are not many good offerings in sight. It were well then for municipal finance officials to take advantage of the opportunity to sell bonds well, as there is an actual demand for good and moderate-priced municipal bond issues.

There have been no bond sales of importance. Cuyahoga county, O., disposed of $150,000 5 per cent. 10-year bridge bonds at 108.21 to the Farmers' and Mechanics' Savings Bank of Minneapolis, Minn., the lowest bid being 104. Then Fitchburg, Mass., sold $25,000 4 per cent. 20-year registered bonds at 104.65 and $50,000 4 per cent. 9-year bonds at 102.539. There are, however, one or two big bond sales in view. The comptroller of New York city is preparing to issue $2,296,959 of 3 per cent. dock and school bonds, exempt from taxation. The comptroller will also retire on Nov. 1 next $2,567,000 city bonds, $612,000 of which are held by the sinking fund, nearly $2,000,000 being 7 per cent. bonds. Then Milwaukee, Wis., is to issue $550,000 5 per cent. park and sewer bonds. Again Brooklyn is to issue on the 15th inst. $570,000 tax certificates, and more bonds will soon be offered for sale. The net debt of Brooklyn on Oct. 1 was $49,164,000.000.

As furnishing to contracting engineers and other interested individuals some indication as to the credit enjoyed by various municipalities and townships, the following table of current offerings is appended:

MUNICIPAL BONDS.

	Price.
City of Breinerd, Minn., School District 6s	107¾
County of Brazoria, Tex., Court House, 6s	103½
Spokane County, Wash., School District 6s	104¾
St. James, Minn., Water Works 6s	107¾
Balar County, Tex., Court House 6s	107½
Park County, Mont., Funding 6s	109½
City of Tracy, Minn., Funding 6s	104¾
City of Pueblo, Col., Gen. Fund. 6s	104¾
County of Flathead, Mont., 6s	107¾
City of Bartow, Fla., 6s	102
City of Pana, Ill., Water 6s	105¾
City of Chicago, Drainage 5s, 1895	100¾
" " 5s, 1914	107¾
Otter Tail County, Minn., Ref. 5s	105
City of Omaha, Neb., City Park 5s	111
Marseilles, Ill., School 5s	102¾
City of Galveston, Tex., Water Works 5s	101½
City of Portland, Ore., Water 5s	112¾
City of Parkersburg, W. Va., 5s	102
City of Cheboygan, Mich., Water 5s	103¾
City of Salt Lake, Utah, Gen. Fund. 5s	108¾
City of Tacoma, Wash., Water 5s	102
Asbury Park, N. J., Water 5s	108
City of East Liverpool, O., School 5s	108
Methuen, Mass, Water 4s	1¾
City of Derby, Conn., Funding 4s	102½
City of Denver, Colo., Public Impvt. 4s	100
City of Brooklyn Water Loan, 4s	107¾
" " Sewer Loan, 4s	109¾

RAILWAY STOCK MARKET.

New York, Oct. 9, 1894.

There is very little to the railway stock market just now. What business there is on the Stock Exchange is practically confined to the "Industrials." As illustrative of how railway shares are neglected, it may be noted that, out of a total listed and unlisted sales of about 1,050,000 shares, nearly 400,000 were shares of the American Sugar Refining Company, while the transactions in 200,000 shares more were confined to Chicago Gas. Naturally trading of this character is almost wholly professional, and fluctuations, even the case of the quotations for railway shares, offer no index as to the status of affairs.

Although there is really nothing at present out of which to make a genuinely active market, yet there are many features to the general situation that warrant one in founding hopes of an early bull movement. While the business of the railways is as yet, it must be admitted, not quite up to the normal standard, none the less the relatively low earnings are not so small as not to be more than offset by the low figures at which most railway shares are at present selling for. And railway earnings are not really so bad. The aggregate of gross earnings of all railways in the United States reporting for September, or a part of the month, is a little over $27,000,000, a loss of 6.7 per cent. compared with the corresponding period in 1893, when the World's Fair rush was on, and of 17.5 per cent. compared with 1892, when general business was very good. The big losses are mostly furnished by the Grangers, as witness the large ratios reported by the Rock Island for the month and St. Paul for the last quarter. On the other hand, the Southern roads show a distinctly improving tendency. The volume of merchandise traffic has been as large, if not larger, this year than last, but last year's much larger passenger earnings keep the figures down.

Again, to come back to a review of the bullishness of the situation, the floating supply of stock is exceptionally light. This scarcity is naturally an element of strength. Furthermore, as favoring the bulls against the bears, is the tremendous ease in money. Nor does this abundance betray any signs of soon being curtailed. Then there is a disposition on the part of the bears themselves to put prices up, so as to be able to sell stocks from higher levels. Whether they can succeed in their purpose must be seen, but the general tendency just now is to look for higher prices, and, once the long-waited-for outside public puts in its long-belated appearance, railway shares will boom.

RAILWAY STOCK MARKET.

Railway stocks.	Closing prices Oct. 9.
Alton & Terre Haute	31
Atchison, Topeka & Santa Fe	5¾
Baltimore & Ohio	75
Canada Southern	50¾
Chesapeake & Ohio	19½
Chicago, Burlington & Quincy	72¾
Chicago & Northwestern	103
Chicago, Milwaukee & St. Paul	61¼
Chicago, Rock Island & Pacific	59¾
Cleveland, Cincinnati, Chicago & St. Louis	38⅞
Delaware, Lackawanna & Western	169
Delaware & Hudson	133½
Hocking Valley	18¾
Illinois Central	92¾
Lake Shore & Michigan Southern	135
Louisville & Nashville	53¼
Missouri Pacific	27½
Missouri, Kansas & Texas	13¾
Mobile & Ohio	19
New Jersey Central	111
New York Central	99¼
New York & New England, 3d asst. pd.	30¾
New York, New Haven & Hartford	181½
New York, Chicago & St. Louis, 1st pfd.	65
New York, Lake Erie & Western	17¼
New York, Ontario & Western	16¼
New York, Susquehanna & Western	15¾
Northern Pacific	4½
Northern Pacific, pfd.	18
Philadelphia & Reading	18¼
Richmond Terminal	17⅞
St. Paul & Omaha	35¾
Southern Pacific	19¾
Texas Pacific	9¼
Union Pacific	11¾
Wabash pfd.	13¾
Wheeling & Lake Erie	12¾

BOSTON RAILWAY STOCKS.

	Oct. 9.
Boston & Albany	206
Boston & Maine	153
Fitchburg, pfd.	77¾
Old Colony	178

PHILADELPHIA RAILWAY STOCKS.

	Oct. 9.
Lehigh Valley	37
Pennsylvania Railroad	51½

NOTICE TO CONTRACTORS.

Sealed proposals will be received by the Council of the City of Eagle Grove, Ia., until 12 o'clock noon of the 20th day of October, 1894, for the construction of water-works.

The works will consist, in general, of steel stand-pipe, steam force pump, boiler, pump ing station, cast-iron mains, and such other appliances as shall make a complete system of water-works.

The plans and specifications now on file in the office of the City Clerk.

The City Council reserves the right to reject any and all bids.

Bonds satisfactory in amount and sureties will be required of the party to whom the contract is awarded. Each bidder will give the names and residences of his proposed sureties.

Cash or certified check, made payable to the City of Eagle Grove, Ia., to the amount of $300, must accompany each bid as a guarantee that, in case the contract is awarded, the successful bidder will, within five days after notice of the award, execute the said contract.

Bids must be sealed and addressed to Eugene Schaffter, City Clerk, and marked on outside of envelope "Proposals for Water Works."

41-2t F. W. PILLSBURY, Mayor.

SEALED PROPOSALS

Will be received by the Building Committee of Beaver Falls, Pa., Council, until 3 o'clock p. m. of Tuesday, October 16th, for two 3,000,000 gallon pumps, and for the building of a 6,000,000 gallon reservoir.

Also, at 3 p. m. of November 6th, a complete filtering plant, with a capacity of 3,000,000 gallons in 24 hours, and buildings to contain the pumps, boilers and filtering plant.

Plans may be seen and detail specifications for the above-mentioned work and material can be obtained of the Borough Clerk, W. W. Kerr, and also at the office of the engineers, James H. Harlow & Co., Times Building, Pittsburg, Pa., and Wilkinsburg, Pa., two weeks previous to the above dates.

At the time and dates above mentioned the several proposals will be received and publicly opened and read. A certified check will be required of bidders for 2½% of bid.

The right is reserved to reject any or all bids.

SAMUEL CREESE, Chairman;
H. F. DILLON,
L. S. LUTTON,
A. O. MEYERS,
40-2t TITUS WELSH,
Building Committee.
JAMES H. HARLOW & CO., Engineers.

NOTICE TO CONTRACTORS.

The City of Vandalia, Ill., will receive bids till 12 o'clock noon, Oct. 18th, 1894, to furnish all material, tools and labor to construct a system of water-works according to plans and specifications which will be on file with the Mayor and Consulting Engineer on and after Oct. 8th, 1894.

Plant to include two ¾-million pumps, about 6 miles of pipe, and standpipe 80' × 15'.

Specifications may be obtained by addressing Mayor or Engineer.

GEO. STEINHAUER, Mayor.
HIRAM PHILLIPS,
Consulting Engineer,
40-2t 810 Olive street, St. Louis, Mo.

DRAINAGE.

Proposals for improvement, Sawmill River Westchester County, N. Y., about 5¼ miles, and draining adjacent marsh lands, appear in Mount Vernon (N. Y.) "Record" and Mt. Kisco (N. Y.) "Recorder." Bids open Oct. 27, 1894.

JOHN F. FAIRCHILD,
Engineer to Commission,
Bank Building, Mount Vernon, N. Y.
40-2t

SEWER CONSTRUCTION, OCONTO, WIS.

Oconto, Wis., will let, Oct. 17, about four miles of sewers.

Address BOARD OF PUBLIC WORKS,
41-1t Oconto, Wis.

U. S. ENGINEER OFFICE, 601 EIGHTEENTH street N. W., Washington, D. C., Sept. 17, 1894.—Sealed proposals for furnishing riprap stone at Occoquan Creek, Va., will be received here until 12 M. Wednesday, October 17, 1894, and then publicly opened. All information furnished on application. CHAS. E. L. B. DAVIS, Major Engineers. 38-4t

U. S. ENGINEER OFFICE, 537 CONGRESS street, Portland, Me., Sept. 14, 1894.—Sealed proposals for dredging in Back Cove, Portland Harbor, Me., will be received here until 3 P. M., Monday, Oct. 15, 1894, and then publicly opened. All information furnished on application to PETER C. HAINS, Lieut. Col, Engrs. 39-3t

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Also flanged Pipe and Fittings, Hydrants, Gates, Pig Lead, etc. CHAS. MILLAR & SON, Selling Agents, Utica., N. Y. Manufacturers of Lead Pipe and Plumbers' Materials. Wholesale Eastern Agents Akron Vitrified Sewer Pipe.

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Sewer and Railroad Culvert Pipe.

Especially recommended for smoothness of inside surface and conformity to true circular shape.

For Price List, Discount, &c., Address

LOOKOUT SEWER PIPE CO., CHATTANOOGA, TENN.

NOTICE TO WATER-WORKS CONTRACTORS.

Sealed proposals will be received by the town of Cambridge City, Ind., up to 8 o'clock p. m. of Thursday, October 25, 1894, for furnishing the materials and constructing a system of water-works for said town.

There will be required about 350 tons of cast iron pipe, 19,000 pounds of special castings, 46 hydrants, brick pumping station and chimney, two pumps of combined capacity of two million gallons per day, two boilers, pump well, the necessary valves, valve boxes, etc.

Bids will be received for furnishing materials above or for constructing the works complete. Proposals must be addressed to M. L. Young, Chairman of Water-Works Committee, and must contain a certified check or its equivalent, made payable to the Treasurer of Cambridge City, Indiana, in an amount equal to two (2) per cent. of the amount of the bid.

Plans may be seen and specifications and blank form of proposal procured at the office of the Town Clerk, Cambridge City, Ind. The right is reserved to reject any and all bids.

M. L YOUNG, President pro Tem.
C H. TABKE, Town Clerk.
VOORHEES & WITMER, Engineers,
Buffalo, N. Y.
October 2, 1894. 41-2t

WATER-WORKS, GIBSON, ILL.

Sealed proposals will be received by the Mayor and Fire and Water Committee of th City of Gibson, Ill., until three o'clock p. m., Oct. 18, 1894, for the furnishing of material and construction of water-works.

The works will consist in general of about four miles or more of cast iron mains, with valves, hydrants, valve boxes, and special castings, pumping station, reservoir, water tower, two boilers, two pumps and two or more 6 or 8 in. wells. Bids will be received for separate portions of the work. Plans and specifications can be seen after Oct. 10, 1894, at the office of the Mayor of the City of Gibson, Ill., and at the office of John A. Cole, consulting engineer, 1580 Old Colony Building, Chicago, Ill. Bonds satisfactory in amount and sureties will be required of those to whom contracts are awarded.

The right is reserved of rejecting any or all bids or of accepting those that in the judgment of the engineer and committee would be for the best interests of the City of Gibson. All bids to be sealed and indorsed on the envelope inclosing them, "Proposals for Water-Works," and addressed to T. D. Spalding, Mayor, Gibson City, Ill.

T. D. SPALDING, Mayor,
J. W. HAINES,
GEO. A. FISHER,
C. F. BUCKMAN,
40-2t Fire and Water Committee.

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The apparatus is small, compact, simple in adjustment, easily set up. It plots automatically a continuous curve for one month, one week, or one day, as may be required. Has been used for several years on some of the Principal Reservoirs and Harbors of the United States and Mexico. Prices greatly reduced.

For circulars and information write to

STANDARD GAUGE CO., No. 24 Haven Bldg., Buffalo, N. Y.

TREASURY DEPARTMENT, OFFICE SUPERVISING Architect, Washington, D. C., Oct. 3, 1894.—Sealed proposals will be received at this office until 2 o'clock p. m. on the 31st day of October, 1894, and opened immediately thereafter, for all the labor and materials required for the erection and completion (except heating apparatus), including approaches, of the U. S. Post-Office at Rome, Ga., in accordance with drawings and specification, copies of which may be had at this office or at the office of the Superintendent at Rome, Ga. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The right is reserved to reject any or all bids or to waive any defect or informality in any bid, should it be deemed in the interest of the Government to do so. All proposals received after the time stated will be returned to the bidders. Proposals must be inclosed in envelopes, sealed and marked "Proposal for the Erection and Completion (Except Heating Apparatus), including Approaches of the U. S. Post-Office at Rome, Ga.," and addressed to CHARLES E. KEMPER, Acting Supervising Architect. 41-2t

TREASURY DEPARTMENT, OFFICE SUPERVISING Architect, Washington, D. C., October 6, 1894.—Sealed proposals will be received at this office until 2 o'clock p. m. on the 7th day of November 1894, and opened immediately thereafter, for all the labor and materials required for the interior finish, plumbing, and approaches for the U. S. Post Office building at York, Pa., in accordance with the drawings and specification, copies of which may be had at this office or the office of the Superintendent at York, Pennsylvania. Each bid must be accompanied by a certified check for a sum not less than two per cent. of the amount of the proposal. The right is reserved to reject any or all bids and to waive any defect or informality in any bid, should it be deemed in the interest of the Government to do so. All proposals received after the time stated will be returned to the bidders. Proposals must be inclosed in envelopes, sealed and marked, "Proposal for the Interior Finish, Plumbing, and Approaches for the U. S. Post Office Building at York, Pa.," and addressed to CHAS. E. KEMPER, Acting Supervising Architect. 41-2t

U. S. ENGINEER OFFICE, 366 Milwaukee Street, Milwaukee, Wis., October 1, 1894.—Sealed Proposals for: Harbor of Refuge, Milwaukee, Wis., extending breakwater, 300 feet; Racine Harbor, Wis., pier extension, 150 feet; Kenosha Harbor, Wis., pier extension, 150 feet; Waukegan Harbor, Ill., pile pier extension, 240 feet—will be received here until 12 o'clock, noon, November 6th, 1894, and then publicly opened. All information furnished on application. JAMES F. GREGORY, Major Engrs. 40-4t

U. S. ENGINEER OFFICE, ROOM H 7, 39 Whitehall St., New York City, Sept. 24, 1894.—Sealed proposals for construction of breakwaters at Duck Island Harbor, New Haven Harbor, mouth of Housatonic River, Conn., and Glen Cove Harbor, N. Y., will be received here until 12 o'clock noon, Tuesday, Oct. 16, 1894, and then publicly opened. All information furnished on application. HENRY M. ROBERT, Lieut.-Col. Engrs. 39-3t

U. S. ENGINEER OFFICE, ST. AUGUSTINE, Fla., Sept. 25, 1894.—Sealed proposals, in duplicate, will be received at this office until 12 o'clock noon, Oct. 25, 1894, and then publicly opened, for delivering 10,000 tons, more or less, of granite or other hard and durable rock upon the jetty at the northwest entrance to Key West Harbor, Fla. All information will be furnished on application to this office. THOS. H. HANDBURY, Major Corps of Engrs, U. S. A. 39-4t

U. S. ENGINEER OFFICE, 601 EIGHTEENTH Street, N. W., Washington, D. C., Sept. 17, 1894.—Sealed proposals for dredging in Occoquan and Aquia Creeks, Va., will be received here until 12 M., Wednesday, Oct. 17, 1894, and then publicly opened. All information furnished on application. CHAS. E. L. B. Davis, Major Engrs. 38-4t

PROPOSALS FOR MODEL BARGES, U. S. Engineer Office, Room 430, Custom House, St. Louis, Mo., Sept. 24, 1894.—Sealed proposals, in duplicate, for furnishing 12 model barges will be received here until 12 M., Oct. 24, 1894, and then publicly opened. All information furnished on application. CHAS. J. ALLEN, Major Engrs. 39-3t

IMPROVEMENT OF DELAWARE RIVER. —U. S. Engineer Office, 1428 Arch St., Philadelphia, Pa., Oct. 5, 1894.—Sealed proposals for repairing and strengthening the pile and stone dike at Bulkhead Bar, Delaware River will be received here until 11 a. m., Nov. 5, 1894, and then publicly opened. All information furnished on application. C. W. RAYMOND, Major Engrs. 41-4t

U. S. ENGINEER OFFICE, WILMINGTON, N. C., Oct. 8, 1894.—Sealed proposals for dredging in Waterway between Beaufort Harbor and New River, N. C., will be received here until 11 o'clock a. m., Nov. 7, 1894, and then publicly opened. All information furnished on application. W. S. STANTON, Major Engrs. 41-4t

U. S. ENGINEER OFFICE, ARMY BUILDing, New York, Sept. 13, 1894.—Sealed proposals for dredging channels in Raritan Bay, N. J., will be received here until 12 m., Oct. 15, 1894, and then publicly opened. All information furnished on application. ROBERT MacGREGOR. Second Lieut. Engrs. 39-3t

U. S. ENGINEER OFFICE, BOSTON, Mass., Sept. 22, 1894.—Sealed proposals for Removal of Ledges from Boston Harbor, Mass., will be received here until noon Oct. 22, 1894, and then publicly opened. All information furnished on application. H. M. MANSFIELD, Lieut.-Col. Engrs. 39-3t

For Other Proposals See P. XIV

CITY ENGINEERS

We are now making large quantities of Vitrified Salt Glazed

STANDARD CULVERT PIPE,

30 INCHES IN DIAMETER, and desire to call your attention to the advantages obtained by its use in place of brick sewers of the same size :

The surface of the pipe being smoothly glazed, the frictional resistance to the flow of sewage matter is much less than in a brick sewer, which gives to the pipe a considerably greater capacity.

The cost of excavation and backfilling in constructing brick sewers is greater than for pipe sewers of same diameter, a wider trench being required to give room for laying brick.

The Pipe Sewer may be constructed more rapidly, the sections being made in convenient lengths of 2½ feet, being easily and rapidly lowered into the trench and adjusted in place.

We are now selling our 30-inch Standard Culvert Pipe, in 2½-foot lengths with Corrugated Deep Sockets, at the reduced price of $1.35 per lineal foot F. O. B. St. Louis, at which price we believe it can be delivered at any destination where the freight is not more than 20 or 25 cents per 100 pounds, and laid in place, at a cost very little, if any, greater than a well-constructed brick sewer of the same actual capacity.

We have this year sold several thousand feet of this pipe for City Sewers, as follows :

City of Waterloo, Iowa, N. K. Fullerton, Chairman Sewer Committee :
1,67[illegible] feet 30-inch Standard Culvert Pipe and Junctions, and other sizes.

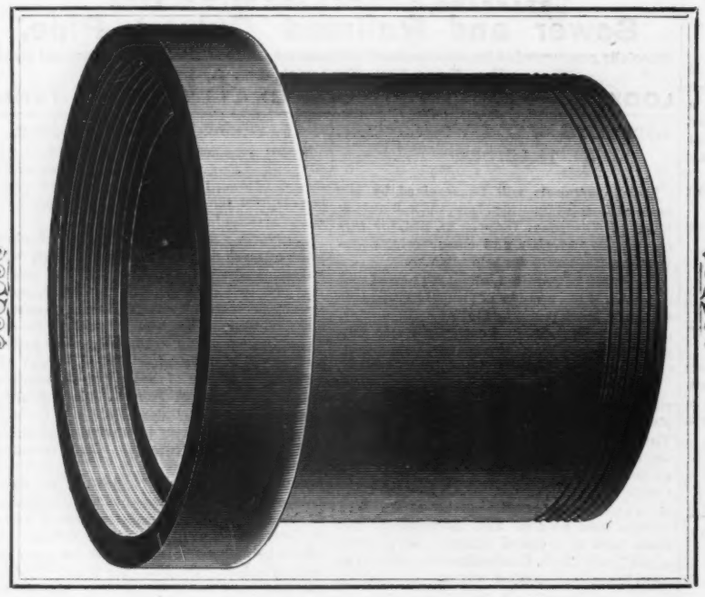
City of La Salle, Ills., C. H. Nicolet, City Engineer :
1,130 feet 30-inch Standard Culvert Pipe and Junctions, and other sizes.

City of Rutland, Vt., Geo. W. Ross, City Engineer :
2,400 feet 30-inch Standard Culvert Pipe and Junctions, and other sizes.

Besides several thousand feet in smaller lots to R. R. Co's and others.

All of this pipe was used in place of brick sewers, and if you are interested we shall be glad to have you correspond with the parties named above, and obtain their opinion of the pipe.

Illustration of one section of 30-inch Standard Culvert Pipe.



We shall be pleased to correspond with interested parties, to quote prices for safe delivery at any required destination, and to send sample of the pipe if required.

Address the Manufacturers,

BLACKMER & POST PIPE CO.,

ST. LOUIS, MO.